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Vol. XXVII No. 1 Toronto, January 1, 1918

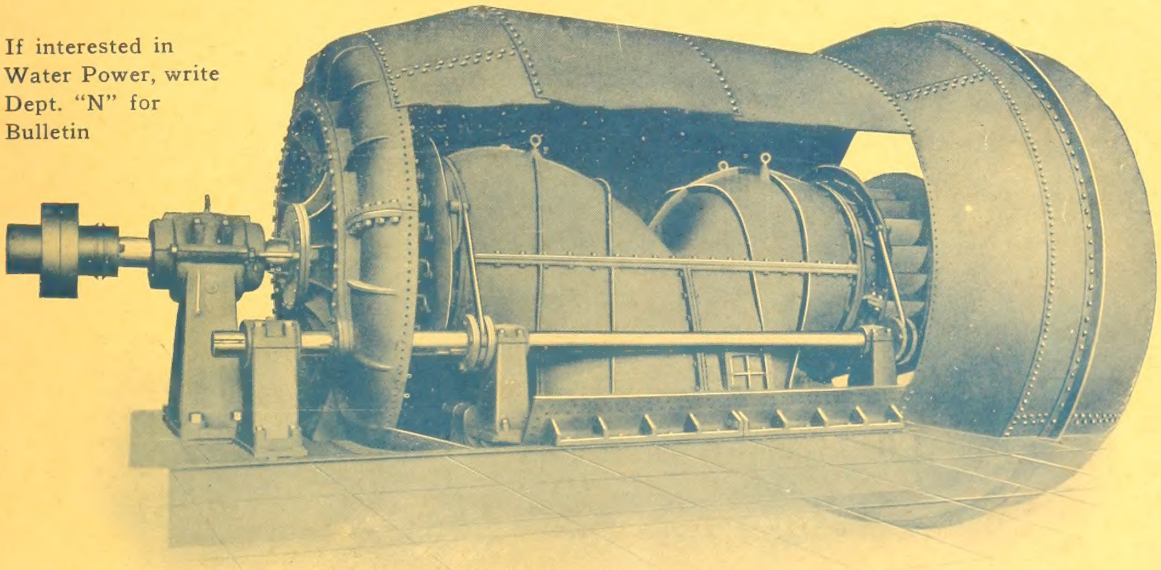
Electrical News

Generation, Transmission and Application of Electricity

Smith Hydraulic Turbines

Have justified their installation in many first class hydro-electric developments where Efficiency, Reliability and Durability are deciding factors

If interested in Water Power, write Dept. "N" for Bulletin



Above illustration shows a pair of Type "N" Turbines, recently installed for International Paper Company, Glens Falls, N.Y., Mill, under 42 ft. head, developing 2000 H.P.

Note the details and general appearance of refinement.

Tests of this type Turbine at Holyoke showed 92 per cent. efficiency. Extraordinary results obtained by horizontal shaft tests of similar Turbines resulted in our furnishing 44 pairs of Type "N" Turbines to Michigan Northern Power Company, Sault Ste. Marie, Mich.

S. MORGAN SMITH CO., York, Pa.

Builders of High-Grade Water Power Equipment

H. B. VAN EVERY—Canadian Representative—405 Power Bldg., MONTREAL

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The Best Known Cable Reel in Canada

In Halifax or Vancouver, whether on the public thoroughfares of our larger cities or smaller towns, wherever there is a cable installation in progress, the reels invariably bear the name of the Northern Electric Company, Limited.

The installation may be overhead, underground or submarine. It may be for a Telephone Company, a Telegraph Company, a Railroad Company, or for a street lighting system.

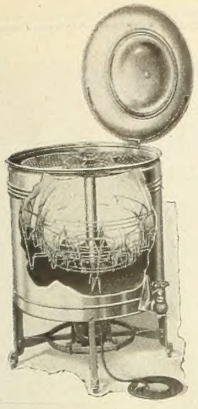
The quality, both of the product and the service, is largely the reason for the universal demand for Wires and Cables of Northern Electric manufacture.

Northern Electric Company
LIMITED

Montreal
Halifax
Ottawa

Toronto
London
Winnipeg

Regina
Calgary
Vancouver



X-Ray View of Dishwasher

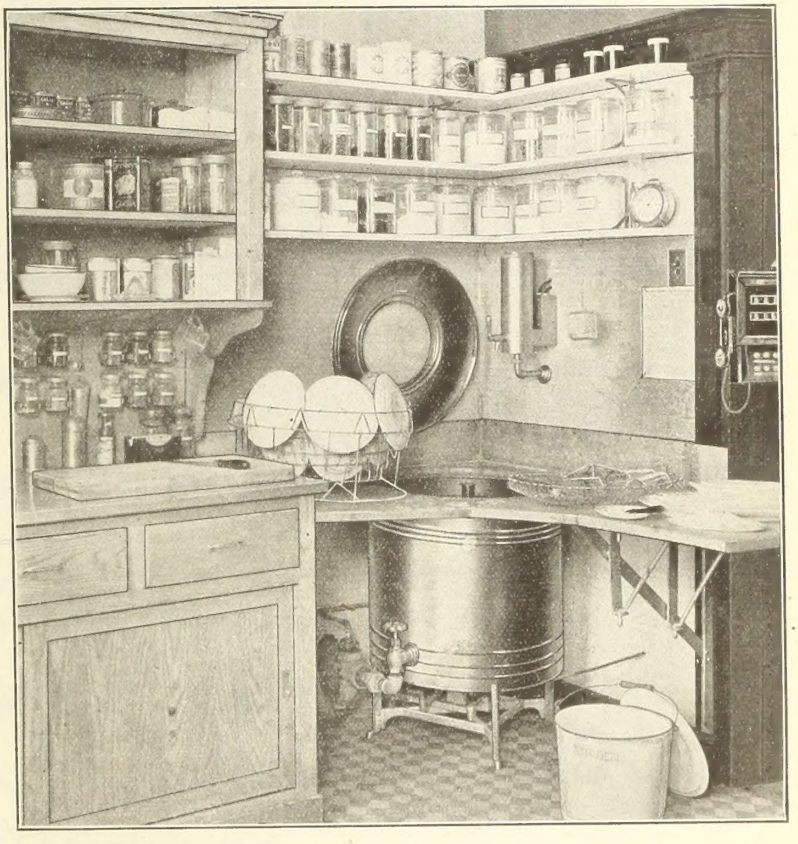
Northern Electric Dishwashers

Solve the Servant Problem

for the woman who does her own housework.

This machine does all the washing rinsing and drying and does it quickly and thoroughly without breaking the dishes or glasses. And what is most important, it does away with the unsanitary dish towel.

Of all the household devices on the market, the electric dishwasher is the most useful. It solves the modern problem of shortage of labor. The NORTHERN ELECTRIC Dishwasher is built in two sizes. The smaller size is suitable for the needs of the average sized family. The larger handles the dishwashing for Hotels, Restaurants, Clubs and large sized families.



Photograph showing Family Type permanently installed



Household Type

There should be a good demand for these dishwashers in your territory, especially during the Christmas season. What more suitable Christmas suggestion could you make to your trade? Besides, we can promise you a very good margin of profit on every dishwasher sold. Write our nearest house for our attractive proposition.

Northern Electric Company LIMITED

Montreal	Toronto	Regina
Halifax	London	Calgary
Ottawa	Winnipeg	Vancouver

National Brackets

CARRY the wires not over, nor around, nor under, but *through* the porcelain insulators. That this is quicker is obvious; that it is cheaper is apparent when tie-wire and labor costs are compared; that it is more secure is evident when it is remembered that the holes through which the wires pass are "iron bound," the construction being similar to that of strain insulators. Write for complete Descriptive Bulletin No. 601, showing one, two and three point styles and applications.

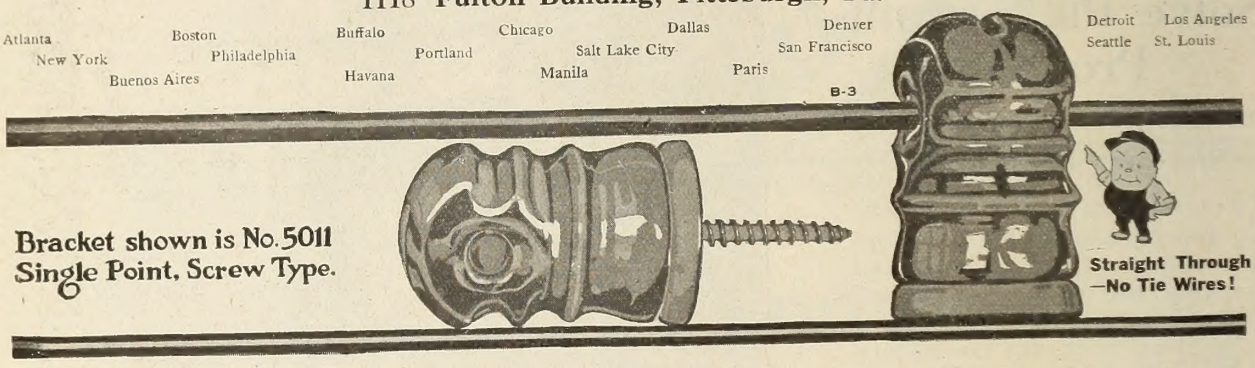
National Metal Molding Co.

Manufacturers of

Electrical Conduits and Fittings

1118 Fulton Building, Pittsburgh, Pa.

Atlanta Boston Buffalo Chicago Dallas Denver Detroit Los Angeles
New York Philadelphia Portland Salt Lake City San Francisco Seattle St. Louis
Buenos Aires Havana Manila Paris



Bracket shown is No. 5011 Single Point, Screw Type.

The

Orpen Conduit Co. Limited

TORONTO

Manufacturers of

XCELADUCT (Galvanized) and ORPENITE (Enamelled)

CONDUITS

Wish their customers

A Very Happy New Year



Showing cars at Youngstown, Ohio, lighted with Keystone Specialties.

Your Cars After Sun-down

During the short day period when the evening rush hours are hours of darkness,
When the theatre traffic is heaviest,
When snow, ice and cold make more dangerous physical conditions prevail—
Then of all times, you should be using "Safety" Car Lighting Fixtures, Illuminated Car Signs and "Golden Glow" Headlights.
Thousands of cars in the States and throughout the Dominion are thus equipped.
Safety, efficiency, economy, attractiveness and comfort are the result. The illustration shows how efficiently—

These Keystone Specialties will light-up your cars



Safety Car Lighting Fixtures



Illuminated Car Signs

Catalogs sent at your request



"Golden Glow" Headlights

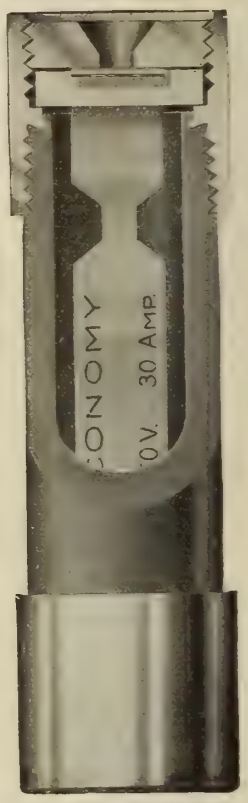
Electric Service Supplies Co.
Manufacturers
PHILADELPHIA, 17th and Cambria Sts. NEW YORK, 50 Church St. CHICAGO, Monadnock Bldg.

Lyman Tube & Supply Co., Ltd.
Canadian Distributors
MONTREAL, Lyman Tube Bldg. WINNIPEG, 302 Donalda Block TORONTO, 33 Melinda St.

YOU DON'T THROW AWAY

Economy Renewable Cartridge Fuses

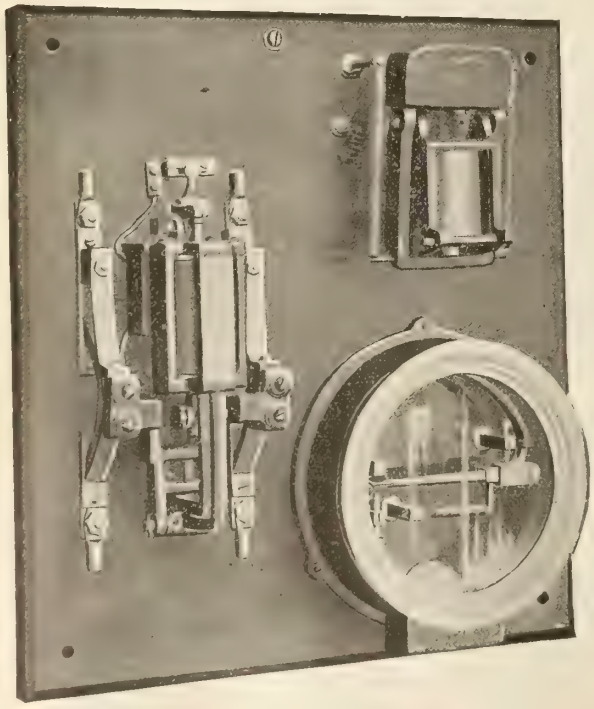
Simple as A B C. Just insert a new fusible element in the old cartridge and this Economy Fuse justifies its name. Good as ever. No fuss or waiting. Very inexpensive. 80% of your blow out expense saved by this method. These fuses are made in Canada and are approved by the Canadian Fire Underwriters' Association.



Write us today for catalogue 20 and sample fuse. Sent free on request.

Economy Fuse & Manufacturing Company
of Canada, Limited
UNITY BUILDING - - MONTREAL

SUNDH PRESSURE REGULATORS



For use in starting A. C. and small D. C. Motors.

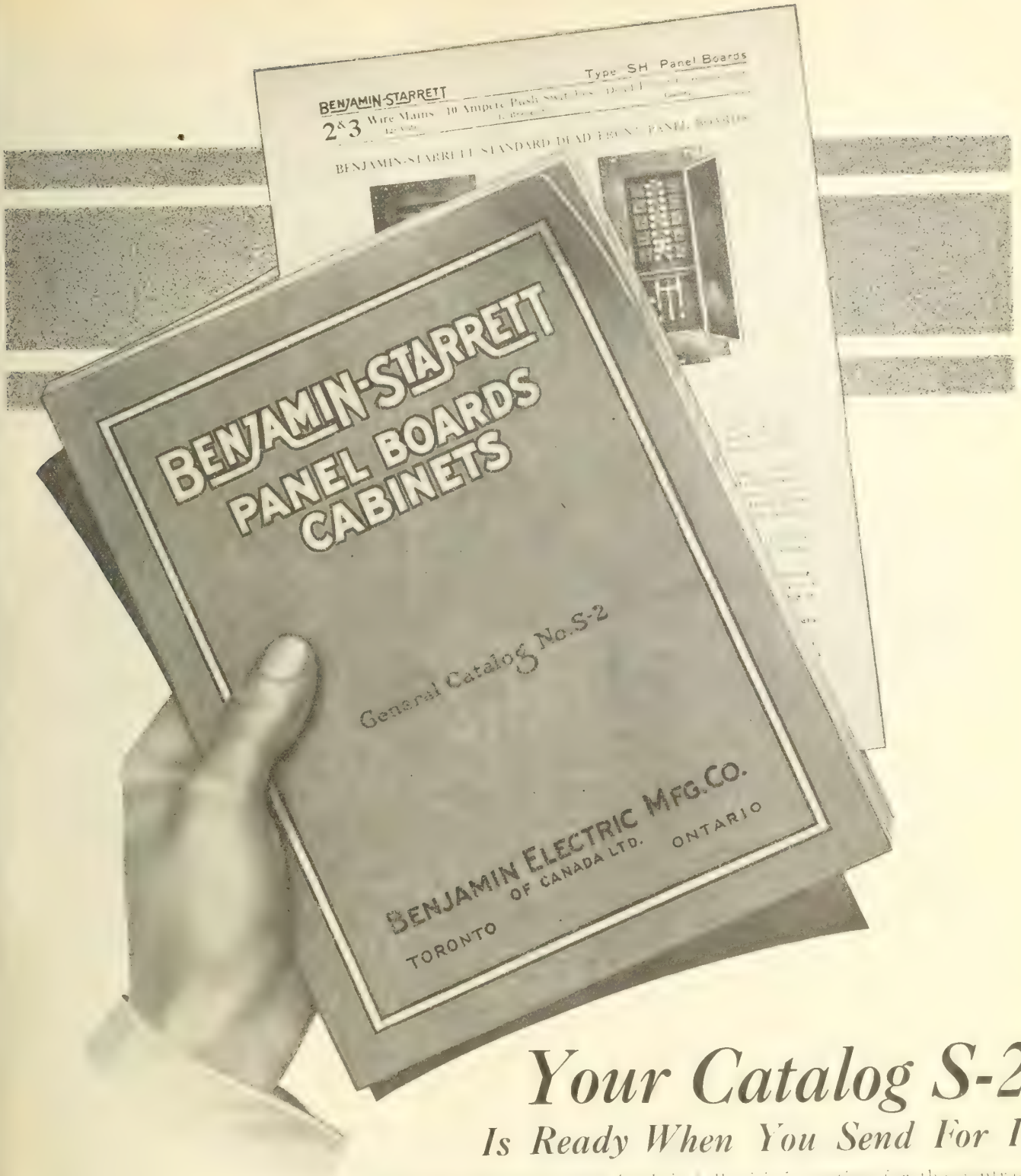
Specially designed for installations where they can be thrown across the line without the use of starting resistance. Compact and reliable and will not get out of order.

When the amperes taken by motor exceed the 10 amp. capacity of the magnet switch, a switch of large capacity is added, the magnet switch acting as a relay.

We manufacture a complete line of controlling devices, such as Motor Starters, Pressure Regulators, Tank and Sump Switches, Panels, etc.

Send for Catalogue.

Sundh Electric Company - - New York, U.S.A.



Your Catalog S-2

Is Ready When You Send For It

This new sixty four page book is full of information for the contractor and the dealer on Benjamin-Starrett Standard Unit Panels. Plan your wiring to use Standard Unit Panels and save the time and expense which is unavoidable when you attempt to use special designs of panel boards.

Benjamin Electric Mfg. Co. of Canada, Limited
11-17 Charlotte Street - - - TORONTO

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THE "TYPE S" PORTABLE WHEATSTONE BRIDGE



Useful in the Shop and Laboratory for the Measurement of Resistance. Adapted for Fault Locations in Telegraph and Telephone Lines and Cables.

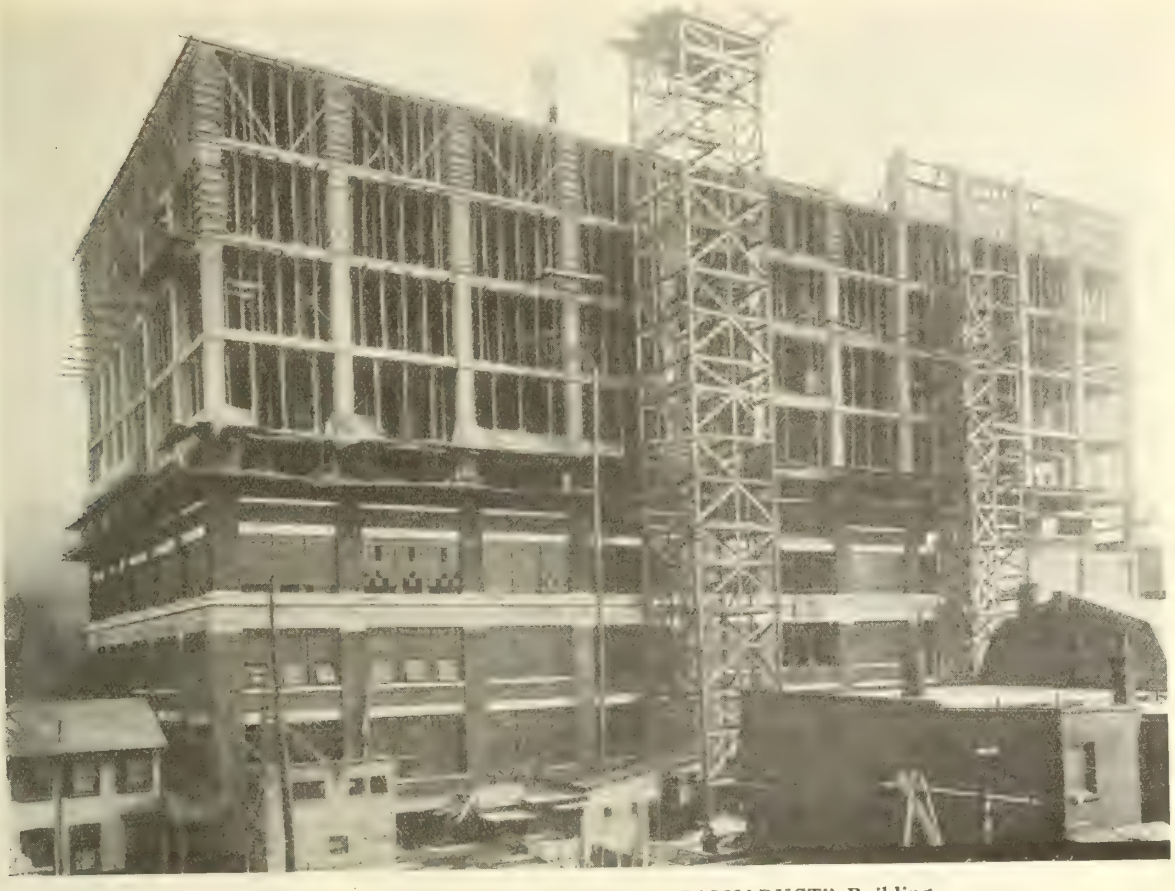
The Type S Bridge is a thoroughly practical instrument for shop and field use. Being complete in every detail it is ready at all times for immediate use. It is easily portable, its weight being but 8 pounds. The precision of adjustment of its coils (Rheostat 1/10 per cent., Ratio 1/20 per cent.) insures accurate measurements. The galvanometer, the weakest element of such an instrument, is unusually rugged. It is a separate element and may be removed for examination or repair by taking out two screws. The battery is of the ordinary "flash light" type, and renewals may be procured practically everywhere. The price is $66.25 net, f.o.b. Philadelphia, boxed for shipment.

Bulletin No. 530 describes this instrument.

THE LEEDS & NORTHRUP CO.

Electrical Measuring Instruments

4912 Stenton Ave. PHILADELPHIA, PA.



Factory of T. Eaton Company—A "GALVADUCT" Building.

"GALVADUCT"

"GALVADUCT"

The most perfect interior construction conduit on the market.

Recognized as the standard of high quality.

Always specify Galvaduct or Loricated

"LORICATED"

A high-class interior construction conduit of the enamelled type, proof against acid or other corrosive agents.

If your jobber cannot supply you—write us.

Conduits Company

Limited

TORONTO

LORICATED

The Democracy of Electricity

Every man and every woman, in every city and town where electricity is available, is a possible user of the "Canadian Beauty" Appliances.

Electric cooking and heating appeal to all—small families and large—because of the greater convenience.

Now that

"Canadian Beauty"

Grills, Toasters, Percolators, Stoves, Irons, etc.

have reached their present perfection, the demand grows steadily greater.

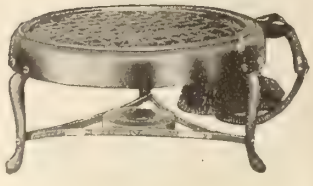
And the Dealer's Proposition grows more valuable, as increasing sales build up the profits.

In addition to giving you a guaranteed line of Electrical Appliances—every one of which has been approved by the Hydro-Electric Power Commission—we are making still more new business for dealers by means of the strongest advertising campaign that has ever been launched in the Dominion for this line of goods.

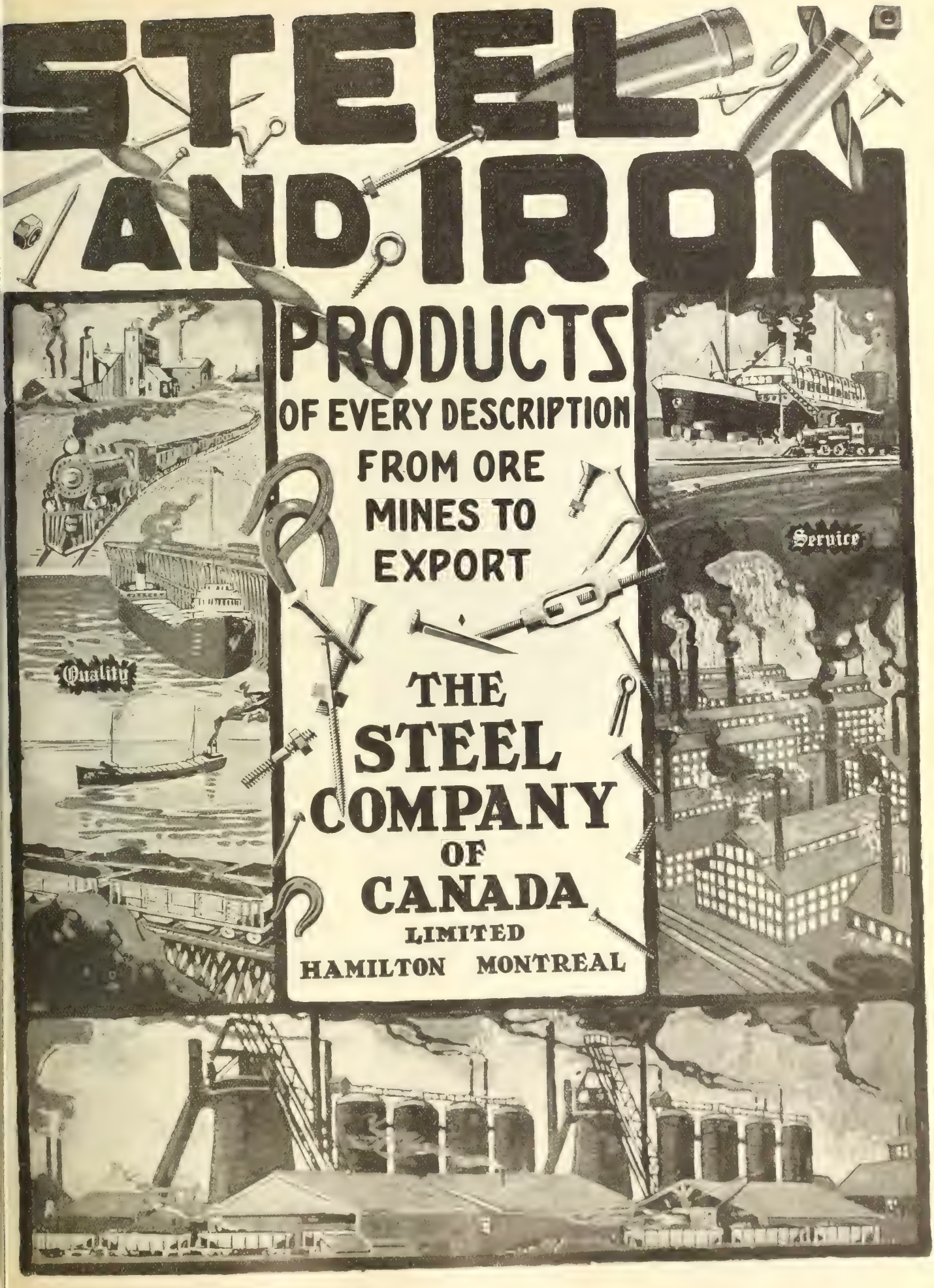
Write for circulars, descriptions, prices.

Renfrew Electric Manufacturing Co., Limited

RENFREW, ONT.




STEEL
AND IRON
PRODUCTS
OF EVERY DESCRIPTION
FROM ORE
MINES TO
EXPORT
Quality
Service
THE
STEEL
COMPANY
OF
CANADA
LIMITED
HAMILTON MONTREAL

Packard

SERVICE TRANSFORMERS

Coils
Impregnated
by
Vacuum Process

—

Perfect
Insulation

—

Mica Barriers

—

Strong
Rugged
Durable



Steel Cases

—

Light in Weight

—

Easy to Handle

—

Will Not Leak

—

Unsurpassed
Appearance

—

Operating
Characteristics
The Best

WELDED STEEL CASES

We Build Large Power Transformers
Special Furnace Transformers
Current and Potential Transformers

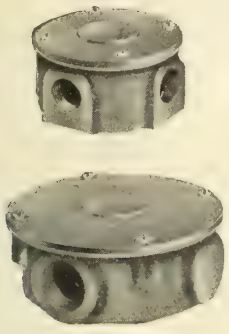
THE PACKARD ELECTRIC CO., Ltd.

ST. CATHARINES, ONT.

Traders Bank Building,
Toronto

Donalda Block,
Winnipeg

Marine Boxes and Fittings



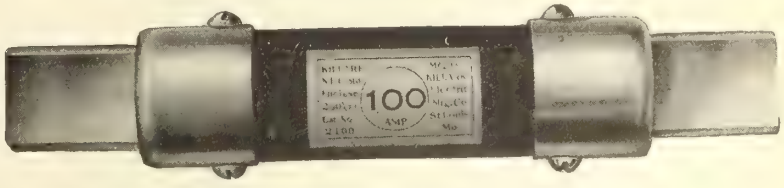
We are now prepared to furnish Special Marine Type Fittings for Shipbuilding Work. Please accompany all requests for prices with blueprints, sketches, or full description.

STEEL CITY ELECTRIC CO.
1209 Columbus Ave., PITTSBURGH, Pa.

"Killark" Fuses

Are Dependable and Accurate

All Sizes—All Styles—Indicating if you want them.



IMMEDIATE DELIVERIES

at a price that means

TRUE ECONOMY

Manufactured by

KILLARK ELECTRIC MFG. COMPANY
ST. LOUIS, Mo.

Canadian Sales Agents

HATHEWAY & KNOTT, Inc.

Electrical Merchandise **120 Liberty Street, New York**

New York Headquarters for the Canadian Electrical Trade



GLASSWARE

for all Lighting Fixtures

Our "Moonstone" and "Lumo" glassware is recognized everywhere for efficiency under all conditions. We illustrate a few lines for interior illumination. Send for latest catalog number five.

Jefferson Glass Co., Limited

TORONTO

CANADIAN PORCELAIN COMPANY LTD.

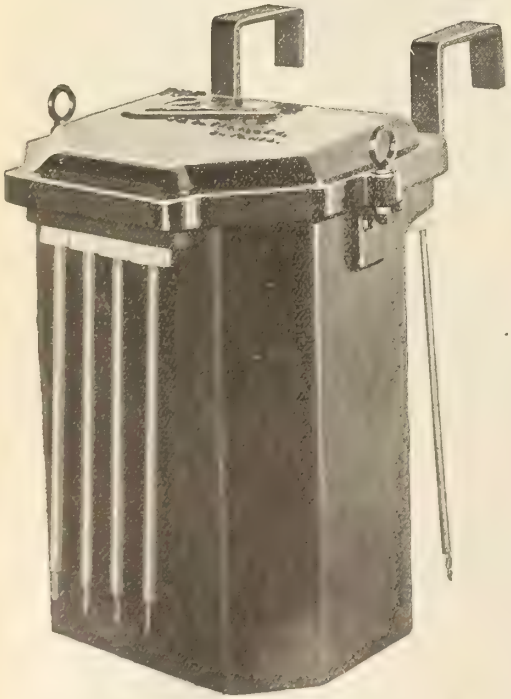
Hamilton - Ontario

Porcelain Insulators

Power Line and Railway Hardware

LET US QUOTE ON YOUR REQUIREMENTS

Proof of the Efficiency and Economy of Oxy-Acetylene Welding



Welded Transformer Case.

Courtesy: Packard Electric Co., St. Catharines, Ont.

Whenever you see a **Welded Joint** you know that it has stood the test in point of efficiency and economy. Follow the example of other leading manufacturers and others in your industry and adopt it, because it can be just as beneficial to you. There is no limit to its uses—no doubt as to its money-saving possibilities.

It Saves Many Times Its Cost:—

For RECLAIMING broken machine parts,
USING material, otherwise wasted,
JOINING metal that cannot be otherwise done,
ADDING metal to parts deficient,
MAKING a leak and trouble-proof joint,
AND many other purposes too numerous to mention.

Will you allow us to tell you how an "A.L.S." Oxy-Acetylene Welding Outfit will SAVE YOU MONEY?

Investigation costs nothing. We are pioneers of the process and best able to give you Service; your interest will be appreciated. Write to-day.

L'AIR LIQUIDE SOCIETY

MONTREAL TORONTO WINNIPEG

HALIFAX factory under construction.

G. M. Gest, Limited

Contracting Conduit Engineers

Head Office
Power Building
Montreal

Vancouver ***Winnipeg***

FERRANTI

METERS

The good reputation of Ferranti Meters is World Wide

Every Ferranti Meter is assembled and tested at Toronto before shipment. Every part is the product of the best British and Canadian manufacture. We can supply meters for all purposes and for any load. Write for bulletins and information.



Single Phase Meter, B. T., Clock Dial

Ferranti Electrical Company of Canada, Limited.

90 Sherbourne St., TORONTO. 704 Unity Bldg., MONTREAL. Farmer's Advocate Bldg., WINNIPEG

FERRANTI FERRANTI FERRANTI



Building Bigger Business by Better Methods

All industries using iron and steel in quantities will find C.G.E. Arc Welders economical, speedy and safe for cutting, joining or building up work.

Ship Yards—Repairs to steel plates.

Blast Furnaces—To clear out frozen tap holes.

Steel Foundries—To cut off risers, to reclaim defective castings, to cut scrap for cupolas.

Rolling Mills—To save worn out machinery and parts such as shafts, frames, spindles, ladles, rolls with wobblers.

Railroads—Repair work from the rim of the wheel to the roof of the cab, fireboxes, seams, piston rods, smoke stacks, fractures to frame work, repairs to steel cars, etc.

General Manufacturing—For construction as well as repair work in automobile plants, locomotive shops, boiler and tank works and general manufacturing.

ARC WELDING OUTFITS

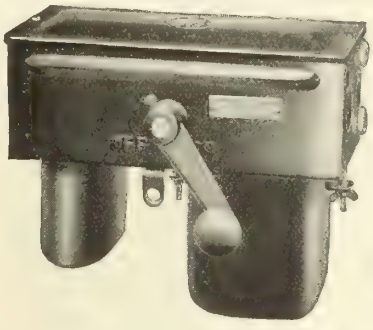
For further information write to our nearest office

CANADIAN GENERAL ELECTRIC CO.

LIMITED

Head Office: Toronto. Sales Offices: Montreal, Halifax, Sydney, Ottawa, Cobalt, South Porcupine, London, Winnipeg, Calgary, Edmonton, Nelson and Vancouver.

This New Oil Circuit Breaker



Type F P-10 Oil Circuit Breaker

gives SAFETY at low cost

This is the lowest priced oil circuit breaker offered by the Canadian General Electric Co., Limited. It is used for controlling small induction motors that can be thrown directly on the line. For the service recommended it is unsurpassed. All live parts, and all moving parts except the operating handle, are totally enclosed, and the breaker meets all the requirements of the "Safety First" movement.

The breaker is furnished in four types: Non-automatic, with double coil overload trip, with low voltage release, or with a combination of low voltage release and overload protective plugs.

The operating handle can be locked open, insuring against accidental or unauthorized operation.

This oil circuit breaker is recommended for 550-volt motors up to ten horsepower or for currents up to thirty amperes at less than 550 volts.

It is simple, compact, small and durable.

Full details in Bulletin 47409

CANADIAN GENERAL ELECTRIC CO., LIMITED

Manufacturers of Electrical Apparatus and Supplies for Railway, Light and Power Purposes

Head Office: Toronto. Sales Offices: Montreal, Halifax, Sydney, Ottawa, Cobalt, South Porcupine, London, Winnipeg, Calgary, Edmonton, Nelson and Vancouver

"FRANKLIN" Post Insulators

A Type for every Service

INSTALL THE "FRANKLIN" AND FORGET IT!



ELECTRICAL DEVELOPMENT AND MACHINE CO., PHILADELPHIA, Pa.

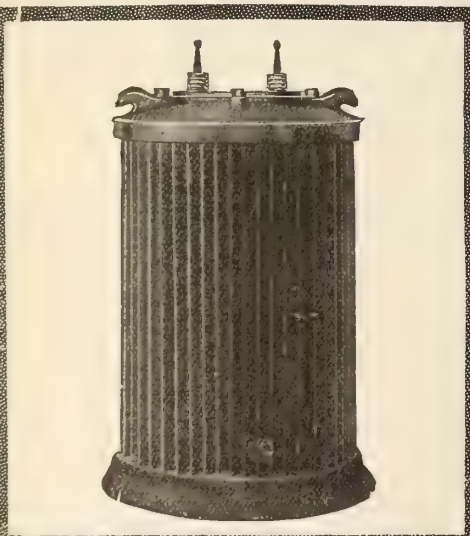
SELLING AGENTS

The Philadelphia Electric Company Supply Department

132 S. Eleventh Street - Philadelphia

TRANSFORMERS

Manufactured for all electrical purposes in any size, frequency or voltage.



Lighting and Power Transformers
High Transmission Transformers
Single and 3-Phase Transformers

To secure prices give us K. W. capacity, voltage, cycles, transformers required.

MADE IN CANADA

MOLONEY ELECTRIC CO.

OF CANADA, LIMITED

Factory
WINDSOR, ONT.

District Offices
Halifax Montreal Winnipeg

General Sales Office
TORONTO, ONT.

Robbins & Myers Fans



THE beautiful finish and graceful design of The Robbins & Myers Fan are a big sales help for the dealer. They attract the customer's attention immediately and carry a strong suggestion of the quality built into the Fan.

The graceful outlines, the smooth, even surface of the drawn steel frame and base, the highly polished brass blades, the neatly constructed guard, the felt base, the smooth, gloss-black, baked enamel finish and the neat gilt stripes are all features of the R & M Fan which make a strong appeal to the buyer and result in easy sales for the dealer. Quality is reflected in the appearance of every detail.

And in every respect—performance, durability and efficiency—the R & M Fan measures up to its appearance. When you sell a Robbins & Myers Fan you know your customer will be just as highly pleased with the service it will give as he is with the appearance. He is insured many years, probably a lifetime of reliable fan service.

Appearance, performance and reputation all contribute to easy, profitable sales when you sell Robbins & Myers Fans.

R. T. Crowley

Manager, Chicago Branch.

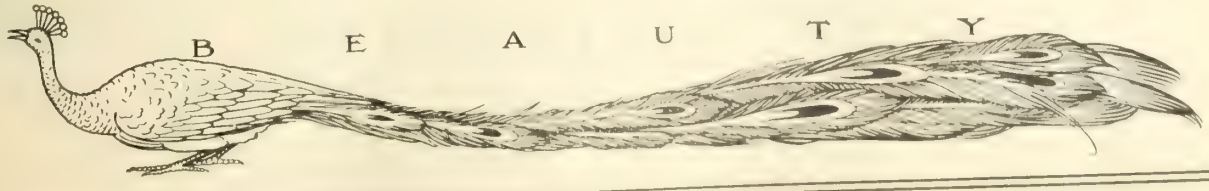
The Robbins & Myers Company

Springfield, Ohio

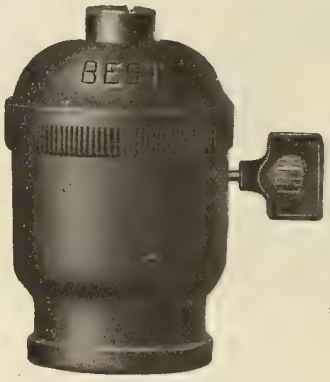
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Rogers Electric Co., Ltd. Toronto



BEST
Wiring Devices



Sockets that are really weather-proof. Cost no more than porcelain.

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U. S. Values Engineering Students

Under an order dated December 8, the selective service regulations issued by the Secretary of War of the United States, exempts certain engineering students from the draft, on the ground that their services are more valuable in the exercise of the profession for which they have specially fitted themselves than they would be as privates in the ranks.

All engineering students are not to be exempted but merely those who have shown special adaptability for the work, and the basis on which the selection will be made is as follows: The faculty of each engineering school will go back through its records of the past ten years and endeavor to establish, on the basis of scholastic markings and subsequent professional performance, a grading above which would be classed one-third of the graduates of the school. Having arranged that grading in any way satisfactory to themselves they will then consider the draft-age students in the school and recommend for exemption those who are apparently above this established grade. It will be seen that this mode of classification may include very many more than one-third, or, it may be, very many less than one-third of the students actually in attendance in any collage.

The point to which we wish to draw special attention is that in the United States they have considered the engineering profession of sufficient importance to grant the students special exemption so that they may complete their courses. The sentiment of the War Department appears to have been voiced in a recent address by ex-President Taft before the annual meeting of the American Society of Mechanical Engineers. Mr. Taft said: "You engineers constitute one of the two professions that are indispensable to the country in the carrying on of the struggle in which the people of the United States are now about to devote themselves—yours and the medical profession. Congress and the Administration should see to it that the medical students and the engineering students should be reserved for the work for which they are particularly fitted; that the engineering students and the medical students should be required to go on and complete their preparation as engineers and physicians so that they may become engineers and doctors and may then be gathered into the service."

What is Canada doing in this respect? Special instructions have been given to exempt medical, dental and veterinary students. No exemption is being granted engineering students. Are engineers less valuable in this war than dentists? Are they occupying a place secondary in importance to veterinary students? If so, why is it called an engineers' war? We have repeatedly voiced the opinion that engineers are almost equally essential with medical men in this war. Is it not time our engineering societies should make themselves heard in an endeavor to influence our government to act along lines which the administrators in the United States not only consider reasonable but absolutely essential?

Engineers—None

Classification of the new members shows that the Canadian Parliament of the coming session will contain:

Lawyers	70
Farmers	32
Physicians	18
Merchants	14
Gentlemen	15
Manufacturers	13
Lumbermen	7
Fruit Growers	2
Military Officers	6
Brokers	4
Publishers	3
Journalists	4
Notaries	4
Advocates	2
Managers	3
Financiers	2
Insurance Brokers	2
Agents	3
Traders	2
Twenty other occupations, each	1
ENGINEERS	0

Overcoming the Peak Problem

There are few places in Ontario where the shortage of electric power is not seriously inconveniencing the public during the present peak-load season. Various means have been adopted in an endeavor to overcome the difficulty, but one of the most satisfactory is that which has been tried out in Brantford, where Mr. W. R. Catton is superintendent of the Hydro-electric System. The scheme generally adopted has been to hold off the street lights until the peak is passed, or to endeavor to get the general public to co-operate and stay off the line during the peak so as to allow the essential factories to operate to full capacity. In Brantford, however, these conditions have been reversed and the manufacturers have kept off the peak and allowed the general public to have free use of their street, office and home service at a time when it is most appreciated. That is, the factories are closed down during the peak instead of, as is the usual custom, running on till about six o'clock. In other words, the factories set their day forward about an hour or an hour and a half instead of asking the general public to

do this. Possibly conditions in Brantford are such that this solution of the difficulty is more easily applicable there than in larger cities, but we are advised that it has worked admirably in that city and we have no doubt it could be applied with splendid results in many other places in this province where there is a present shortage of power.

Hamilton Cataract Power, Light and Traction Company's Section of the C.E.A.

The first regular meeting of the 1917-1918 season was held in the assembly room of the section, Terminal Station, on Thursday evening, November 29th, at 8.15 p.m. Mr. C. H. Fry, chairman of the section, presided. The meeting was unusually well attended, and the program very interesting and instructive. The evening started with a very pleasant function in the shape of a presentation of a wrist watch to Mr. Wm. Dorland by the members of the sub-station staff. For many years Mr. Dorland has been assistant superintendent of sub-stations under Mr. W. A. Sweet, the occasion for the presentation being his transfer and promotion to the position of superintendent of the company's power house at Decew Falls.

The guest of the evening was Mr. M. C. Gilman, sales manager of the Toronto Electric Light Company, and the newly elected secretary-treasurer of the Canadian Electrical Association. The feature of the program, however, was a paper presented by Mr. E. S. Jeffries, electrical engineer for the Steel Company of Canada, entitled "Electricity in the Steel Industry," and profusely illustrated with lantern slides. The various uses to which the electric current is put in the modern production of iron and steel was a surprise to everyone. It demonstrates that the present tremendous rate of production of steel is only possible by the use of the "silent servant."

The Jovian Order in Winnipeg

At the bi-weekly luncheon held by the Winnipeg Jovians on November 1, Major B. A. Cousin gave an interesting talk on his experiences at the front, in connection with the infantry operations in several of the memorable battles, and also on his work as artillery observer.

The former secretary-treasurer of the Winnipeg Jovian League, W. E. Skinner, of Minneapolis, Minn., also gave an interesting talk on the great work being done in his city and other points south of the line in connection with war preparations, and described in detail the manner in which the second Liberty Loan was followed up by the citizens' committees, resulting in such an unqualified success.

About forty members and guests listened with great interest to these talks. A representative body of Winnipeg Jovians also attended the bi-weekly luncheon at the St. Charles Hotel, Thursday, November 15, to hear Comptroller-General J. Gordon Steele speak on "The Functions of the Auditor in Public Affairs." The speaker dealt fully with the different phases of a modern auditor's services and gave a comprehensive talk on the functions of his profession. Mr. B. F. Griggs, auditor for the Greater Winnipeg Water District, gave a brief outline of the auditor's work in connection with that project, and dwelt particularly on the essential qualifications of a successful auditor.

The Winnipeg Jovian League have forwarded Christmas parcels to every member fighting for the glorious cause of democracy over at the battle front, and endeavor to keep in as close touch with them as possible. The Jovian Order, as well as the Winnipeg Jovian League, are carrying these members in good standing while on active service.

Winnipeg Jovians are just drawing up a schedule for another bowling tournament to be held very shortly, as this social sport has always proved very popular among the members.

The Place of the 50-Watt Mazda B Lamp

The following item appears in the last issue of the N. E. L. A. Bulletin regarding the 50-watt Mazda B lamp. It was prepared and submitted by the Lamp Committee of the N. E. L. A.:

The 50-Watt Mazda B Lamp

In the report of the Lamp Committee submitted this year the opinion was expressed that a determined effort should be made by central station companies generally to secure the introduction of the 50-watt lamp, and it was shown that the prediction made by the committee last year that this unit would meet with rather general adoption has been borne out by experience.

The tungsten filament lamp originated in Europe. In the early period of development, American manufacturers were inclined to follow European practice. Early progress was in the direction of finer filaments and smaller lamps. Beginning with the 100-watt lamp, the 60-watt lamp was developed, then the 40-watt, then the 25-watt, etc. These sizes were adopted because they corresponded approximately with the sizes of lamps which had been developed in Europe.

Later, American manufacturers assumed the lead in development of the tungsten filament lamp. It then became apparent that in following European practice in the development of smaller sizes too many sizes of lamps had been provided. The steps between some of the sizes were needlessly small. This occasioned unnecessary expense in the manufacture, handling, and stocking of lamps. A study of American conditions, with a view to remedying this difficulty, led to the conclusion that the best selection of sizes for the ordinary lamps would be as follows: 25 watts, 50 watts, 75 watts, and 100 watts.

The gradual substitution of lamps of these sizes for lamps of the sizes adopted under the stimulus of early European leadership has been undertaken. The 50-watt Mazda B lamp was made available early in 1916 and the 75-watt Mazda C lamp followed in July, 1916. The progress which has been made thus far tends to confirm the conclusion reached in advance, that the recently approved steps of 25, 50, 75, and 100 watts are well suited to American conditions.

Distribution of Different Sizes

The recent report of the Lamp Committee shows that during the calendar year 1916, 6.90 per cent. of all the Mazda B lamps of central station types produced during the year and sold to all kinds of users were of the 50-watt size. The distribution of demand among the sizes used for general lighting purposes was as shown in the middle column of the following table. The demand for 50-watt lamps has been greatest among central station companies. For example, the Lamp Committee is advised that the demand for 50-watt lamps by the members of the Association of Edison Illuminating Companies during the year ending April, 1917, formed 27.42 per cent. of the total demand for Mazda B lamps of the general lighting classes. The last column of the following table shows the demand of that association:

Watts.	N.E.L.A. demand.	A.E.I.C. demand.
15	6.98 p.c.	4.60 p.c
20	2.25	0.72
25	29.70	17.42
40	33.42	23.42
50	6.90	27.42
60	20.75	26.42
	100.00	100.00

The 50 watt lamp preserves the standard [illegible] to which central station customers have become accustomed through years of development. It is of substantially the same physical dimensions as the 50-watt carbon and the 50-watt Gem lamps. Its price is the same as that of the 40-watt lamp. Its life performance is known to be entirely acceptable. It deserves all encouragement at the hands of member companies.

It has become evident that standards of illumination intensity in various classes of lighting service vary with time. The standards in many classes of approved modern lighting practice are about as much in excess of those of ten years ago as the light production of the Mazda lamp per watt is in excess of the light production of the carbon lamp per watt. They are still low as compared with the standards of daylighting, even in interiors. As more efficient lamps become available, and as the public avails itself more extensively of the benefits of electric lighting, it is probable that the levels of illumination intensity will be raised considerably beyond the present standard. The 50-watt lamp as a substitute for the carbon and Gem lamps of ten years ago is, therefore, of an illuminating power which is by no means excessive. Indeed, in some cities the 60-watt lamp has found acceptance as a substitute for the old 50-watt carbon lamp in similar lighting practice.

Necessity for Diffusion

The advancing standards of lamp efficiency are accompanied by increasing brightness of light source. For satisfactory lighting results, the Mazda B lamp, and even more so the Mazda C lamp, should be concealed from view. For all purposes the light produced by these lamps should be diffused to some extent, the extent varying with the purpose to which the light is put. For some purposes it is desirable to alter the hue of the light somewhat in order to meet local decorative demands. The accomplishment of these ends involves an absorption of perhaps 50 per cent. of the light which is produced. As illuminating engineering principles are disseminated, the demands for diffusion and coloring of the light will become more general. Under these conditions the 50-watt Mazda lamp, considered in connection with the advance in the standard of illumination intensities which has been described above, will be too small a unit satisfactorily to replace the old 50-watt carbon lamp under the conditions which surrounded its use ten years ago, including the lower level of illumination intensity, the lesser need for diffusion of light, and the general lack of knowledge concerning illuminating engineering principles, and the advantages to be obtained from its adoption.

In these circumstances, the 50-watt lamp ought to find general acceptance at the hands of central station companies, and it ought everywhere quickly to outstrip in demand the 40-watt lamp, as it has already done in the practice of some member companies.

"Lightless" Days

A new regulation in New York provides that electric signs and all other unnecessary lighting be darkened on Sundays and Thursdays. These are, in effect, "lightless" days and the principal hotels and theatres are not only reducing their exterior lighting, but also from one-third to one-half the lights in public rooms and corridors. By this means it is hoped to realize a considerable saving in fuel.

Of two hundred and forty-seven persons who met violent deaths in Toronto during the year 1917, only four were electrocuted.

Electrical Training for Soldiers

By Douglas C. McMurtrie*

Electrical work in its various branches is proving a popular way in which to train soldiers crippled in the present war. It is one of the leading subjects of instruction at Queen Mary's Hospital, Roehampton, England, where there are at any one time hundreds of men with amputated limbs awaiting the fitting of artificial arms and legs and being meanwhile prepared for return to civil life—independent and self-supporting.

At the Pavilion Military Hospital, Brighton, there are likewise electrical classes, carried on in Queen Mary's Workshop, operated in conjunction with this centre for the care of limbless soldiers. There is provided instruction preparatory to various openings which call for a knowledge of electrical machines, lighting, telephones, and bell systems. The men are trained as electrical assistants and for attendants in private houses, theatres, hotels, business houses, workshops, mills, coal mines, and so forth. There is also a special course to enable men to qualify as switchboard attendants at electric power stations.

The Institution of Electrical Engineers, in co-operation with the London public educational authorities, has organized classes for training disabled soldiers and sailors as electrical substation attendants. The instruction is given at the Northampton Polytechnic Institute. Up to the present time 150 men have completed the course. The instruction comprises workshop practice in wiring and the use of simple tools, power-house demonstrations, electrical and physical laboratory work, class demonstrations in the elements of electrical engineering and of simple engineering physics, the writing of reports on demonstrations and laboratory work, and, in conclusion, an oral examination.

At the Regent Street Polytechnic, in London, there are courses of a similar nature. Here are received for more advanced training men who have done preliminary work in the hospital at Roehampton. The men are first instructed in general electrical work and then passed on to the London United Tramways for experience in generating plant and substation practice. This course takes from two to three months.

Second Most Popular Course

At the Battersea Polytechnic, in London, the principal says that the second most popular course offered to crippled soldiers is that in electrical testing or switch-board work. "We have trained successfully men suffering from shell shock and nervous trouble, together with other types of disablement. A fair education is required for this work, together with ability to do simple calculations. For this work we do not mind taking men who have only partial use of an arm or hand, as it often happens that the fuller use of the arm is simply a matter of time. We do not, however, care to take those who have actually lost an arm, and we would rather not have them if they have lost a leg, although the latter is not so important as the former. We have been able to place all the men who have been through this work, and the firms are willing to take other men when they become ready for work. We think this work offers reasonable wages and conditions."

The Fife Mining School, Cowdenbeath, England, conducts a course for electric motor and switchboard operatives. Some of the men are preparing to be underground motor attendants in the mines; in these cases their electrical

training is supplemented by preparation for a mine fireman's certificate.

A communication from the director of the school gives the following syllabus of the course:

What happens when an electric current passes in a conductor. Heating, glowing, and fusing of a wire carrying a current. Use of fuses. Tests with fuse wires. Replacement of fuses.

Resistances and their use in controlling currents. Measurements of electrical currents and pressures. Elementary notions of the construction of ammeters and voltmeters. Range of the instruments. Precautions to be observed in their use. Conductors and insulators. Insulated conductors of various types. Arrangement of conductors in series and in parallel circuits. Uses of porcelain, rubber, paper, slate, marble, etc., as insulators. Jointing. Construction and use of blow lamp and soldering iron. Making of married and T joints on conductors. Sweating of joints, thimbles, and connectors. Switches of various types and their use in the control of electricity.

Motor starters and their care and proper usage.

Trip devices. General arrangements of a switchboard.

Testing. Use of test lamp and detector for sorting out circuits. Pole finding.

Electric bells and indicators.

General idea of a direct-current generator.

General idea of direct-current motors.

General idea of the construction and use of a battery of accumulators, and of how it should be cared for.

Practical exercises in operating direct-current generators and motors and in charging a battery. Some simple notions of alternating-current generators and motors and on the synchronizing of two alternating-current generators.

The conception of national responsibility to the disabled soldier, not only to pay him a pension but to re-educate him in some trade which he can follow in spite of his handicap, was recognized for the first time early in the European war. It is now realized that the cripple, while perhaps unable to take up again his former trade, is not debarred from all occupation. The effort is always to select some trade related to the former occupation of the disabled man; in this way his former experience is not lost. A competent journeyman bricklayer who has lost an arm may be prepared by a suitable course in architectural drafting and the interpretation of plans to take a position as construction foreman of a bricklaying gang. It would be idle to give such a man a course in telegraphy. But a train hand who has been all his life familiar with railroad work may most wisely be trained as a telegraphic operator, with a little commercial instruction on the side.

The first country to make adequate provision for the trade-training of war cripples was France, where a school was started at Lyons a few months after the opening of hostilities. Now there are hundreds of instruction centres in the various belligerent countries. Even Belgium has several schools to meet the needs of her disabled soldiers.

In Canada the work is national, being carried on by the Federal Government, which has established throughout the Dominion schools for war cripples.

American interest in the subject is growing daily. In New York there has been established the Red Cross Institute for Crippled Soldiers and Sailors, made possible by a gift of more than $50,000 from Jeremiah Milbank. Committees have been formed and plans for reconstruction centres are under way in Chicago, Boston, and other cities. The surgeon-general's office of the War Department has announced its intention to establish training centres in connection with the great base hospitals.

Electric Welding Methods and Apparatus

Electrical welding apparatus is now used for cutting, joining, and building up metals in the manufacture of new machinery or other articles and in the repair and alteration of old ones. Electric welding has found a practical application in nearly all metal working industries, from the manufacture of small sheet metal boxes, small and complicated metal parts, such as those used in watches, to the building of great steel steamships and the structural work of modern skyscraper buildings and bridges. Iron, steel, copper, brass, and various other metals and alloys may be welded with varying degrees of success dependent upon the properties of the metals.

In this article, reproduced from Electrical Record, the practical features and characteristics of welding apparatus are dealt with rather than the processes of welding, so that no attempt will be made to enter into a discussion of the theory of the welding of metals.

Two Classes of Welding

Welding work may be divided into two general classes—forge or pressure welding and autogeneous welding. The first class is the one in which the pieces of metal to be united are heated until they are slightly softened and then pressure is applied by means of a hammer or lever, forcing them together and causing their particles to unite into what is known as the weld. A familiar example of forge or pressure welding is the work done in the blacksmith's shop by means of the forge fire, the anvil, and the hammer. The term autogeneous welding is applied to welds which are made by heating metals to such temperature that they will fuse together on contact without pressure being applied. The difference between autogeneous welds and those formerly described is mainly the difference in temperature of the metal. In the autogeneous weld the metal is heated to a state of fluidity and the two pieces flow together. The use of the autogeneous process, however, is not confined to the uniting of two pieces of metal. It is used to even a greater extent for adding metal to other metal pieces or parts, thus building them up or filling defects.

Classification of Welding Processes

A—Pressure Welding: 1. Forge, anvil and hammer. 2. Electric—(Alternating current)—Spot, butt, etc.

B—Autogeneous Welding: 1. Thermit welding. 2. Oxy-acetylene welding. 3. Electric arc welding (direct current). (a) Bernardos process. Carbon or graphite electrode, filling material introduced separately. (b) Slavianoff process. Metallic electrode, which is itself consumed for filling material. (c) Zerener process. Two carbon electrodes held in "V" form with points within field of electro-magnet.

Forge or pressure welding includes one of the two general processes of welding by means of electricity, and this process may be classified as electric pressure welding, under which heading butt, spot, cross, tee, and other forms are grouped.

Autogeneous welding may be divided according to three main processes, these being the thermit, oxy-acetylene, and the electric arc. These divisions and subdivisions may be

readily understood by reference to the accompanying tabulation of welding processes.

Electric Welding Processes

Welding by means of electricity as shown in the above classification may be divided into two general groups—pressure welding and autogeneous welding. In the former classification the metals to be joined are heated by the electric current being passed through the metals, the resistance causing the development of intense heat, which softens the metals, so that, upon the application of pressure, the two parts are united into a single piece. In this classification fall spot welding, butt welding, cross welding, tee welding, and similar processes.

Spot Welding

In spot and butt welding, alternating current is used because of the possibility of transformation from a relatively high to a relatively low voltage without loss of energy. Spot and butt welding machines consist essentially of an alternating current transformer and suitable electrodes. The transformer takes current at the ordinary commercial voltage and steps it down to the voltage used for this class of welding, which is about 3 to 5 volts. The two electrodes consist of copper rods of generous diameter, usually water-cooled, or, in the case of butt-welders, electrodes made in the shape of jaws, to which the work may be clamped. Means are provided in both spot and butt-welders for exerting pressure between the electrodes, which are generally connected by lever linkage to foot pedals or hand levers. The service lines are connected to the primary side of the transformer and the electrodes are connected to the secondary side.

In operation the work is placed between the electrodes and the current is turned on. At the welding voltage the current value, which may be varied to suit the work, is greatly increased and the resistance set up by the work which is interposed in the circuit causes the generation of intense heat. Within a certain time, varying from a fraction of a second to a half minute, or slightly longer, depending upon the size and physical properties of the metal worked on, the metal becomes softened at the point of application of the heat, so that upon the exertion of pressure by means of the foot pedal or hand lever controlled by the operator, the two parts to be welded are pressed together, causing the particles of metal to unite into a single homogeneous mass. Pressure is then released, the work removed and set aside to cool, as a completed joint.

Spot welding takes its name from the fact that the electrodes are pointed, and the welding takes place at certain spots or points wherever the work is applied. Spot welding is largely used for sheet metal work, and has been found to be largely applicable to work which formerly required the punch and rivet method. Spot welding is not only more rapid but cheaper than riveting, and the work turned out is usually more satisfactory, since the two pieces of joined metal virtually become one.

The operation of welding takes place in a vertical direction, the arms or horns of the spot-welder operating in an up-and-down direction, while the work is presented from a horizontal position.

Butt Welding

Butt welding machines operate upon a theory similar to that followed in spot welding, the difference being, as the name implies, that the butts or ends of the metal are joined rather than the sections of sheet metal worked on in spot welding. Butt welding machines operate in a horizontal direction. Heat is applied by the resistance set up by the work to a current of high amperage and low voltage obtained through a transformer similar to that used in the spot welding machine. The electrodes are equipped with clamps in which the rods or other pieces of metal to be worked may be fastened. The current passes through the jaws and clamps with little resistance, but, upon encountering the metal, great resistance is set up, which generates heat sufficient to soften the metal. Then pressure is exerted by the operator upon a lever so as to force together the two jaws having attached the heated bars, in such a way as to produce the proper joint.

Cross Welding, Etc.

Cross, ell, tee, and various other names are applied to welding by means of spot or butt welders, and merely signify the shape of the pieces of metal joined.

Arc Welding

Electric arc welding is an autogeneous process, and requires apparatus totally different from that used in pressure welding. In arc welding, as the name implies, the useful agent is the electric arc, and because of the characteristics of alternating current a steady arc cannot be drawn, since the alternating current varies from a maximum to a minimum at each reversal of the current. Therefore, direct current service is essential to electric arc welding. Since arc welding is an autogeneous process, in which the metals to be joined are brought to a state of fluidity, no pressure is necessary. The voltage required for arc welding is between 20 and 50 volts, while the current value varies from 15 to 600 amp., or upwards, depending upon the character of the work. The electric arc emits rays which are harmful to the eyes of the operator unless protected, and, therefore, face and hand shields, or both, form a part of the equipment for arc welding. The apparatus required for electric arc welding consists of a suitable source of direct current energy at the voltage and current value specified, means for controlling the value of the voltage and current, the electrode of metal or carbon or graphite for drawing the arc, and the face and hand shields.

Since direct current of special characteristics is required for arc welding, it has been found generally desirable to use an especially designed generator. Commercial voltages of 110 to 250 volts cannot be used economically, for the reason that in stepping down with direct current, resistance must be used which would absorb a large proportion of the available energy and make the use of current by this method extremely inefficient and expensive. Therefore, where electric power is available the source of energy for electric welding generally takes the form of a motor-generator set or dynamotor, the driving end being wound for operation on the electric service available, either from a central station or private generating plant, and the generator end being wound to give the special characteristics required for the welding arc. Where direct current is used in the plant, a dynamotor consisting of two sets of windings mounted in a single frame and running on a single shaft or a d. c. motor generator set may be used.

Arc Welding Processes

Before proceeding with a further description of the apparatus used and its application, a short discussion of the theory of arc welding and the various processes employed will be outlined to give a clear understanding of the apparatus used.

There are three general processes by means of which arc welding is carried out, named from the men who were responsible for their development. Two of these are in general use, while the third has a somewhat limited application.

Bernados Process

The Bernados process is especially adapted for large and heavy work. It consists of drawing an electric arc between the work and a single carbon or graphite electrode, and is the same as that known as carbon or carbo-graphite electrode welding. The arc is drawn by touching the electrode to the work and withdrawing it to the proper distance to maintain

similar to the action of an arc lamp when starting. The temperature of the arc is approximately 3,500 degrees C., and the heat is confined to a comparatively small space directly in contact with the arc. The intense heat of the arc on striking the filling metal causes it to melt rapidly and flow into place, and as the arc is moved over the work the filling metal and the molten metal of the work unite in an intimate mixture or weld. This process is principally used with large electrodes and heavy currents for heavy work on large pieces of metal, although by the use of small electrodes and low current values the process may be used in welding comparatively light material.

Slavianoff Process

This process is commonly known as metallic electrode welding, since it consists in using the work as one electrode, the hand of the operator. The electrode itself is therefore gradually consumed during the progress of the work. The arc is drawn by touching the work with the metal electrode and drawing it away until an arc of the correct intensity is obtained, in a manner similar to that followed with the Bernados process. In general, this method will make a softer weld than the Bernados process, since there is no tendency for carbon to be carried into the weld. Because of the action of the arc in carrying the metal from the electrode to the work it is possible to weld on a vertical wall or overhead, and for this reason the process is of great value where repairs are made to parts which cannot be removed and placed in a horizontal position.

Zerener Process

The Zerener process consists of an arrangement of the positive and negative carbon electrodes in a holder so that they form a "V," the arc being between the poles of a power-electro-magnet, which forces the arc toward the work. This causes the arc to act in a manner similar to the flame of a gas torch, but because of a certain sensitiveness, inefficiency, and complication the process is not used as extensively as the Bernados and Slavianoff processes. It is used to a limited extent for comparatively small work in steel and brass and for welding small corners in tubes and tanks.

Arc Welding Apparatus

As previously mentioned, the source of energy for arc welding is usually a special low voltage generator, since this is far more efficient and economical than the use of reduced voltage from a commercial supply line by means of resistance. The generator may be driven by a direct-connected motor where electric service is available or by belt from line shafting, or steam, gas, or gasoline engines in plants where electric service is not used.

The gradual refinement of electric arc welding apparatus has led to the development of two distinct types of generating equipment known as constant voltage welders and variable voltage welders. The manufacturers of each type set forth certain arguments as to the advantages of the particular system employed. The object to be attained is the maintenance of a constant temperature at the arc, regardless of variations in the length of the arc, which are bound to occur, due to the unsteadiness of the hand of the operator or the unevenness of the surface being worked upon.

Constant Voltage Welders

Constant voltage welders consist of direct current generators wound to deliver a voltage of approximately 60 to 75 volts, this current then passing through an adjustable resistance controlled by automatic magnetic switches and relays, or in some cases by hand or motor-operated switches or rheostats. In some types of constant voltage apparatus magnetic contactors operate the resistance in accordance with the drawing of the arc, so that when the operator brings his electrode into contact with the work the current is limited by all of the resistance in the circuit, but when he draws the arc the automatic contactor cuts out a part of the resistance and allows the current to come up to the amount required for welding. In another type of constant voltage welding apparatus, resistance is used, but automatic regulating devices are eliminated and dependence for the maintenance of constant current value is placed upon the automatic compensation, which occurs simultaneously with any change in the length of the arc. The theory is that the lengthening of the arc, intentionally or otherwise, introduces additional resistance into the welding circuit, thereby reducing the amount of current flowing. This, however, means that the voltage across the arc rises slightly. If the arc is shortened the reverse action takes place so that the heat produced, which is proportional to the product of current times voltage, will remain practically unchanged for any length of arc with which work can be done.

The constant voltage system is generally adapted for a number of welding circuits which are supplied by a single generator, each welding circuit being equipped with a welding control panel, which is mounted separately from the generator control panels. The generator control panels are not essentially different from the control panels supplied for the control of generators supplying power for lighting and general power purposes, since they carry indicating instruments, protective apparatus, and switches arranged for regulating the output of the generator. Separate outlet panels may be provided for each welding circuit, each panel carrying a circuit-breaker and line switch and the necessary resistance adjusting switches for regulating the heat of the arc by varying the amount of current supplied to the arc. Arrangements are made whereby one or more of the welding circuits may be operated simultaneously, the only limit being the capacity of the generator. Constant voltage generating equipment is also arranged for single welding circuits, in which case the welding control instruments and the generator control instruments are usually mounted on a single panel.

Variable Voltage Welders

This type of apparatus operates upon the theory that in arc welding the voltage of the current actually used is continually changing. At the moment the operator touches the electrode to the piece of work the voltage in the circuit is nearly zero, and as he draws the electrode away the voltage constantly increases as the arc lengthens. To produce this result the variable voltage generators are designed to deliver the exact voltage required at the arc at any particular moment. Ballast resistance for the regulation of the welding current is therefore not necessary in this case. The variation of the voltage is obtained by manipulation of the strength of the generator field by means of either hand-operated or magnetic switch and push-button-operated field rheostats, or by a separate electrical machine mounted on the same shaft as the generator and known as an exciter. As the resistance of the arc varies, due to the changes in its length, the voltage is varied proportionately, thus maintaining the value of the current at approximately a constant figure.

The variable voltage apparatus is generally supplied for a single welding circuit—that is, a generator set and the other equipment is provided for each operator. Where greater capacity is required than the capacity of the relatively small single circuit generator, the usual arrangement is to connect two generating units together and thus obtain the double capacity.

Portable Welding Apparatus

Electric arc welding apparatus may be used either in the shop where the various units are permanently installed or the complete equipment may readily be mounted upon a truck for portable operation. Portable welding apparatus for shop use is generally built upon a small truck, which may be moved by hand, while portable welding apparatus for use in

the field may be mounted upon motor trucks, or, when used by electric railways, is mounted upon small cars, which may be run from one place to another upon the tracks of the system. The portable shop welding apparatus is arranged so that the motor may be plugged in at convenient points where connections are provided so that a single welding equipment may be used in various parts of the shop as the progress of the work requires. Electric railways use portable arc welding equipment to a great extent in the repair and maintenance of tracks, in which case the motor end of the set is wound to operate upon the usual railway voltage. Portable outfits may be obtained for use where electric service is not available, the prime mover in such case generally consisting of a gasoline engine, which is direct connected or belted to the welding generator.

Auxiliary Welding Equipment

In addition to the motor generator set or other source of energy for welding and the arc control panels for the control of the equipment, the apparatus required for electric welding consists of the electrode holder and masks or shields for the protection of the operator's eyes, face, and hands.

The electrode holder is a handle provided with means for connecting the cable at one end and for clamping the carbon or metal electrode at the other end. Holders for carbon or graphite electrodes generally are provided with shields to protect the operator's hands, somewhat similar to the guard on a fencing foil. The face shield or mask is made of sheet metal generally, arranged with straps for fastening the mask over the operator's head. A lens of colored glass is inserted in the opening to neutralize the rays of the arc. In some types of apparatus for metallic electrode welding the shield is arranged to be held in the operator's hand, and does not strap over his head for the reason that with metallic electrode welding the operator uses only one hand, whereas with graphite electrode welding one hand holds the electrode and the other hand holds the piece of filling metal.

Electrical Developments During 1917

In accordance with their usual policy the Westinghouse Electric & Manufacturing Company have sent out a review of developments in electrical apparatus as manufactured by the company during the year 1917. It is noted that the unprecedented demand for apparatus and appliances has called for abnormal efforts to speed up production and this has left little time or energy to be devoted to the development of new apparatus or modifications of existing types. The year, however, has not been barren of developments, and the most important of these are given briefly in the article which follows:—

Generating Equipment

The past year has seen little that is radically new in generating equipment. More units of large individual capacity have been contracted for than ever before, due to the growth of the larger central stations. The Westinghouse Company has sold several large units ranging from 40,000 to 70,000 kw. capacity and these either have or are now being installed. Those units above 40,000 kw. are of the cross compound or triple element type. Among those reported last year but just recently installed may be mentioned the Duquesne Light Company, Pittsburgh, a 40,000 kw. cross compound unit; Narragansett Electric Company, Providence, a 45,000 kw. cross compound unit; and the Interborough Rapid Transit Company, New York, a 70,000 kw. triple element unit.

One of the developments brought about by the high cost of materials, labor, etc., such as the high cost of copper, has been an increased tendency towards the use of synchronous condensers for both power factor correction and voltage regulation. In many cases the installation of such apparatus saves an increase in transmission line copper, or allows additional load to be taken on a given transmission line, and at the same time permits the maintaining of normal and satisfactory voltage conditions.

There may be mentioned the completion of a number of 150,000-volt outdoor oil circuit-breakers of rupturing capacities far in advance of anything heretofore within the limits of high voltage breakers. These breakers have round instead of elliptical tanks, domed instead of almost flat tops, and are of all steel construction, with the result that guarantees of their withstanding possible internal pressures of 190 pounds have proven very conservative. In fact, with the guaranteed arc rupturing capacity with voltage maintained of 1,000,000 kv.a. it is felt that questions of high-voltage power concentration is solved for at least some time. Similar breakers with same guarantees are also being built for 110,000 volt service.

Among other developments might be cited the frame-mounted, indoor and outdoor high powered steel top, 73,000 volt breaker; combination 37,500 volt and 132,000 volt outdoor, single-pole, disconnecting switches and choke coils all on a common base with a resulting net saving of one insulator supporting column; and 66,000 volt post-type bus supports and disconnecting switches.

Typical of the attention constantly being given to improvement in switchboard mounting devices is the development of a very compact and improved drum type circuit-breaker controller. Likewise along the same lines may be mentioned the completion of an adequate line of meter switches (also of drum type), key operated, including ammeter, voltmeter, synchronizing frequency meter and power factor meter switches. With the completion of these, all plug switches for meter switching can be eliminated, thus insuring the entire absence of any potential from the front of panel boards or control desks.

Increased use of outdoor switch houses has been noted; a considerable number of installations have now been made which control circuits up to 6600 and 11,000 volts. Single orders received involving as many as ten houses are proof of claims made as to the economy represented by their use for distributing small amounts of secondary voltage power from transmission lines in connection with outdoor step-down transformers.

There may also be mentioned the development of what gives promise of being a highly successful and yet simple control equipment for automatic rotary converter sub-stations. One such outfit has been in successful operation for some time and others are under construction. To a very large degree, the bulk and complexity of earlier control equipment for such installations have been eliminated.

Lightning Arresters

The principal change in electrolytic arrester design has been in the main gap. The use of sphere gaps in combination with horns first came into use as a special design, and later was adopted as standard by all manufacturers on all

down the gap and discharge to ground through the arrester. For the protection of apparatus on railway cars further developments have been made in the use of condensers by surrounding the condenser with a moulded insulating case, making an easily replacable unit impervious to moisture. The capacitance has been increased to 1 mf. in all forms of arresters, both car mounting and pole mounting, giving a static discharge capacity sufficient to take care of the worst conditions found in practice.

Oil Circuit Breakers

The tendency towards the development of breakers of very large interrupting capacity at all ranges of voltage has continued during the year, in order to take care of the increases in generating capacity throughout the country. The requirements of the situation have produced breakers for use up to 155,000 volts having the capacity to interrupt 3750 amperes at the contacts. This line consists of round tank breakers from 95,000 to 155,000 volts, having domed steel tops and bottoms with operating mechanisms inside the top, thus securing maximum strength in all directions against internal stresses.

Motor Operated Graphic Instruments

A line of motor operated graphic instruments has been added to the Westinghouse line of solenoid operated instruments in order to make the line more applicable for portable service and for metering large customers' demands. These instruments are made as a.c. and d.c. voltmeters, a.c. and d.c. ammeters, a.c. wattmeters, totalizing wattmeters, and frequency meters. They embody the same measuring element as used in the solenoid operated type instruments and, therefore, have the same accuracy characteristics. They differ from the previous line of solenoid control instruments, in that the contacts of the measuring element actuate a small universal motor, driving a worm upon which the pen carriage is arranged to travel. The case is also somewhat smaller and designed for rear connection. The clock is so arranged that the standard paper speeds can be obtained without changing it.

Sub-stations

The developments in sub-station apparatus have been relatively small, due to the great amount of active business, making it almost impossible to even put through experimental work contemplated. Various improvements in details of converting apparatus have been made, which tend towards better sub-station apparatus ventilation, lower maintenance, longer life, and better economy. The outstanding feature in the past year has been the production of sub-station switching equipment, that is entirely automatic. This equipment switches the apparatus on a fundamentally sound basis, that is, the machines are switched at the proper time, depending upon the electrical condition of the machine controlled. There has been little doubt as to the value of attendantless sub-stations, the only doubts having been the lack of sufficiently reliable automatic equipment. This new development, therefore, should be of inestimable value to the electric railway industry.

Street Lighting

The most notable addition to street lighting during the year is a fixture for the high current street series lamps of large candlepower. It is made of cast iron and is suitable for either auto transformer or film cut-out socket. Similar fixtures, which have been in service several years, indicate that this is a very desirable modification, as the cost of equipment can be reduced without sacrificing any desirable qualities. The increased use of the skirted type of Holophane refractor with fixtures for street lighting service, indicates the growing appreciation of the ideal distribution given by this simple device.

Street Railways

During the past year the standard line of Westinghouse railway motors has been supplemented by the type 577 motor, having a rating of 200 h.p. at 800 volts. This motor is especially suited for heavy subway service, and a large number are now going into service. It lends itself to heavy interurban service where exceptionally heavy duty is required, and is in striking contrast to the "Wee" motor brought out by the company, which is the pioneer motor in quick service single truck car application. It is gratifying to note and of decided advantage to the trade to report stability in design of the present line which enables the user to standardize for some time to come. The multiple unit types of control previously reported are coming into their own. Scarcity of labor and heavy peak load haul has now convinced the user of the advantage to be obtained.

Regeneration has been extended to ordinary interurban application, especially in locomotive service, and this development will rapidly extend in this field.

The past year has seen considerable detail development and improvement in apparatus pertaining to electrification of steam railroads. The requirements for heavy freight traffic on mountain grade sections have been met by the production of a very powerful split phase locomotive motor having several improvements over those previously built. This locomotive, while only weighing 250 tons complete, has a horse-power capacity of 4,800, and a maximum tractive effort of 130,000 lbs., all of which is concentrated in one single unit. The most interesting improvement in this type of locomotive is the synchronous phase converter, by which 100 per cent. power-factor is obtained, thus eliminating some of the line losses which were encountered with the induction type phase converter.

The high voltage direct current system has also shown advance in the production of a high powered passenger locomotive. The rating of this locomotive will be 4,000 horsepower and the starting tractive effort will be 112,000 lbs., while the total weight will be 266 tons. This engine will also be a single cab unit.

Regenerative control for direct current locomotives has been perfected to such an extent that it is now applied whenever desired to 600 volt units as a standard. This feature contributes very largely to the safety in operation of the electric locomotive, and its principal value lies in the fact that it relieves the air brakes from considerable strain and enables them to be used as a reserve for stopping trains only.

The development of high speed circuit-breaker methods for suppressing flashing in high voltage direct-current apparatus has taken very forward steps during the past year and the indications are that this serious trouble in machines of this class has been definitely suppressed. These devices are of various kinds and very unique in character, the details of which will receive publicity at a later date. These detail developments have put the electrical industry in a position of preparedness for the more general electrification of railroads, which it is anticipated will become very active in the near future.

The Steel Industry

The electrification of steel mills is progressing at a very rapid rate. The business of the company during 1916 and 1917 is more than three times as great as for the average of the five previous years. During the past year the company received an order for one of the largest reversing mill equipments ever built, this machine having a maximum rating of 17,500 h.p., and will be used to drive a 60-inch universal plate mill for the Bethlehem Steel Company.

Rubber Industry

There has been developed during 1917 what is known as a tandem type controller for calender work, which is of

the magnetic switch type and is controlled from a push button station. Besides the convenience offered by the latter, it adds to the safety feature, as the motor can be stopped from various stations conveniently located to the operator. Other safety features are included affording overload protection, automatic acceleration, etc. In this particular case, the calenders are located in tandem, in some cases as many as four machines being operated in series. With the old arrangement of drive, the calenders were operated as individual units, and after the process in each individual calender was completed, the material had to be wrapped up and taken to the next machine, and the work thus carried on independently by the various machines. With the new arrangement, the material passes from one machine to the other in a continuous process which saves time, labor and materially increases production. The control mentioned above makes possible the proper regulation of drive, and is considered a great improvement in rubber mill work.

Textile Industry

A new type of apparatus developed this year which is used extensively in the textile industry is a quick make starting switch. It is used where squirrel cage motors of comparatively small capacity, i.e., up to 25 h.p. max. 220 volts are started with full line voltage. Besides the quick make and break features, it has the following combinations: non-automatic switch; switch with low voltage protections; switch with inverse time element overload protection; full automatic switch with low-voltage and inverse time element overload protection.

There has been a marked tendency during the year for the textile industry to install individual drives, as compared with group drives, and it is believed that very rapid progress is going to be made in the development of this idea. There have also been a large number of plants changed over to electric drive—in practically all cases using central station power.

Small Motor Drive Devices

The business in small-motor-driven devices used in the home, office, and shop during the last year has been very active. As in all other industries, the activity has been more pronounced in connection with those motor-driven devices which contribute either directly or indirectly to the carrying on of the war. For instance, there has been a large sale of motor-driven drills, grinders, polishers, and small tools generally. This has also been true in the case of motor-driven machines required in the preparation of food and those in the home which are distinct labor savers, such as electrically-driven washing machines. The extreme scarcity of household help has created a very large demand for these. On the other hand, the demand for non-essentials, such as motor-driven pianos, talking and recording machines, office appliances and advertising novelties have become less active.

Electric Vehicles

In the electric vehicle industry, the principal activity has been in industrial trucks used in factories and other munition plants. The total demand for pleasure vehicles has been quite small.

General Industrial

In the industry covering the equipment of electrical apparatus for public buildings, there has been a great deal of activity, due principally to that of industrial rather than public buildings. It appears quite likely that the public building and residence industry will be very severely affected, in fact this is already noticeable. Considerable electrical apparatus has been purchased by bakers and all those engaged in the manufacture or preserving of food products. Likewise, the clothing industry has been a very active one.

The Farm

The prosperity of the farmer and the scarcity of labor on the farm has made an abnormally large demand for electrical equipment in the comparatively small areas where central station current is available, and particularly in the demand for small isolated lighting plants, many of which are supplied with storage batteries. This has resulted in demand for low voltage motor-driven pumps, washing machines, vacuum cleaners, churns, separators, and similar devices.

Arc Welding

The advance made in the past year in arc welding has been important. Heretofore, the arc welding voltage has been 75, but the company has recently designed a new line of arc welding equipment with an operating voltage of 60 volts, and also the machines are running at the highest and most efficient speeds. The drop in voltage from 75 to 60 will mean a saving in power. Further, this company has developed portable welding outlet panels which will simplify the shop wiring and will decrease the total expense of the installation.

Metal Mining

As in other industries this year, in the metal mining field there has been developed a control panel offered where a wound rotor motor is used. It combines a circuit-breaker controller and meter in conveniently small space and prevents the motor being thrown on the line without resistance in the secondary circuit. Several new ratings of Cottrell equipment, including motor generator sets, transformers, and synchronous induction motors were brought out during the year so that a standard equipment to meet most commercial conditions can be furnished. For the flywheel hoisting sets, the greatest improvement has been in a control, as the cam type controller for the generator field rather than the old face plate type is furnished.

The company has brought out a complete line of semi-automatic ranges, which have a contact thermostat on the oven doors that rings a bell when a predetermined temperature is reached which may be varied by manually setting the contact point on the thermostat. This prevents the housewife from scorching foods, as the bell calls her attention to the fact that the maximum temperature has been reached and the current should be turned off. This alarm, of course, also prevents overheating of the oven lining, and rapid deterioration. This line of ranges supplements the full automatic ranges which are arranged for automatic turning of the current on and off.

Personal

Mr. M. C. Gilman, sales manager of the Toronto Electric Light Company, has been appointed secretary-treasurer of the Canadian Electrical Association, succeeding Mr. Alan Sullivan, who resigned recently to go overseas.

Mr. John N. Timberlake has resigned his position as power apparatus sales engineer, Northern Electric Company, on his appointment as Montreal district sales manager of R. E. T. Pringle, Ltd., with an office at 401 New Birks Bldg.

Mr. R. H. Balfour, sales manager of the Eugene F. Phillips Electrical Works, Limited, Montreal, has been elected a director of the company. The capital of the company has been increased to $4,000,000, and a new charter, with more extensive powers, obtained.

Mr. W. J. Wilkinson, formerly manager of the Northern System of the Ontario Hydro Commission, with headquarters at North Bay, has resigned to accept a position as manager of the North Bay Toy Company. H. D. Rothwell, one of the Commission's engineers employed in the Municipal Department, succeeds Mr. Wilkinson.

Transmission Line Practice—Conductors

By Lieut. E. T. Driver, B.Sc., and E. V. Pannell, Assoc. I.E.E.

[Never did a more urgent demand exist for cheap and plentiful electrical energy than at the present time. The manufacture of munitions of war, the production of nitrogen compounds for explosives and for stimulating natural food resources and the conservation of fuel all call for electricity cheaply generated and transmitted most efficiently and economically from the falls to the factory. In this connection we have arranged for a series of articles on the economics of transmission, of which the present and first one deals with conductors.—Editor].

ARTICLE I.—CONDUCTORS

Although wires or cables of copper or aluminium constitute by far the majority of the conductors in use for transmission line work, the last few years have seen the introduction of certain conducting materials of greater diversity and better adapted for special conditions. It will be of interest as an introduction to a series of articles on transmission line engineering to consider, side by side, all the various materials in use at the present time as conductors. These may be divided into three groups: (a) Simple materials; (b) compound materials, and (c) alloys. In class (a) are copper, aluminium and steel (steel is, properly speaking, an alloy, but it is more convenient in the present connection to consider it as a simple metal). Class (b) comprises copper-clad steel, hemp core copper and aluminium-steel, and class (c) includes the light aluminium alloys and bronze. It is most logical to compare these different cables on the basis of conductance; as a rule the losses in the line are the determining factor and a wire or cable of a certain definite number of ohms per mile is the starting point in the comparison. Copper has been assumed as the standard conductor and the other materials lined up with it.

Copper

The oldest and still the most important material in use as a conductor needs little introduction. The manufacture of copper wire or cable for transmission line work may be outlined briefly as follows: Electrolytically refined metal of 99.9 per cent. purity is received by the mills in the form of cast billets weighing around 250 pounds each and being about eight inches square in section. The shape of the wire bars is practically a square prism with rounded corners and slightly convex sides to enable the breaking down rolls to take a firm pinch. Rolling takes place whilst the bars are hot from the re-heating furnace and the maximum amount of work is put upon the metal with a view to securing wire of high physical quality. The section of the rods during the running-down changes from square to diamond, then to an oval, round and oval successively so that the interior fibres of the metal are thoroughly worked. This procedure, together with a reasonably large number of passes, secures the utmost strength and elasticity possible to attain. When the rods are rolled down to .375 or slightly smaller they will be nearly one thousand feet long and they are then coiled and sent on to the wire-mill, being first pickled and tumbled to remove the scale, after which further reductions are made upon the wire-blocks. Drawing copper wire usually takes the form of one pass for each number on the B&S scale so that wire of 10 B&S will probably take twelve passes from the rod. After every half-dozen or so passes it will be necessary to anneal the wire, and if the product is required to be soft it will be annealed within one or two passes of the finishing block. It is now general to anneal copper and other metals in a water-seal muffle. In this process the coils of wire on a belt conveyor travel through a water trap when entering and leaving the heating chamber. Air is therefore excluded and no scale is formed on the metal. Hard drawn copper wire of the quality requisite for transmission work having a tensile strength of 50,000 to 60,000 lbs. per square inch generally has several high speed finishing passes after the last anneal. After finishing it is laid up in a strander to 7, 19, 37 or, for exceptionally large sizes, 61 wire cables, is reeled, and is then ready for test and acceptance.

Aluminium

The foregoing processes apply not only to the manufacture of copper cables, but also with slight modifications to wires of aluminium and all other metals. Aluminium is not produced in a smelter and electrolytically refined like copper, but is actually reduced by an electrolytic process. The metal blocks are then graded and those showing over 99.4 per cent. purity are reserved for electrical work. They are cast into wire bars of precisely the same shape as copper, but owing to the lower density of aluminium the bars of the same size are somewhat less than one-third the weight of copper. Ninety pounds is a standard aluminium wire billet. The billets are rolled down when hot by the two-stage process, as described for copper, and where material of extremely high tensile strength is required the finishing pass is sometimes given when the rod is practically cold at very high speed. This sometimes leads to trouble on the wire blocks, however, and it is better that the rods should be as soft as possible when they reach the wire mill and that extra high strength be attained by extra passes. Rods of .500 and .375 are passed direct from the rolls to the wire-blocks, there being no scale to remove by pickling or tumbling. Moreover, the wire can be reduced three times as many passes as copper between anneals. However, the bulk per pound is more than three times as great as copper so that the costs of manufacture per pound are slightly higher for aluminium. The tensile strength and conductivity can be varied, and as with copper, the softer the wire the higher will be its conductance. The best compromise is reached with metal of 60 per cent. the conductance of soft copper; higher values than this can only be attained at the cost of tensile strength.

Steel

The occasional use of a ferrous metal for transmission lines has been dictated for two entirely different reasons. In general it has been found undesirable to use copper or aluminium on spans greater than about 2,000 feet in length; to secure a reasonably small sag, wires of high tensile plow-steel are strung on such crossings. In this case the distance run by the steel conductors is so short compared with the total length of the line that the reactance of the steel is negligible. On the other hand, iron and steel wires have been employed in recent years for purely economic reasons, and in some countries because of the scarcity of copper. In this latter circumstance the reactance of the steel has naturally been a most troublesome factor to take care of. Many small branch distributing lines are being operated in America with steel wires. In these cases the resistance of the smallest practicable copper wire would be much lower than necessary and iron or steel wire of the same size carries the load quite satisfactorily without excessive voltage drop. The chief disadvantage of the ferrous material, according to recent reports, appears to be deterioration.

The increased resistance of steel wires is due to a num-

ber of factors, the most important of which is the skin effect. The magnetic field in the conductor confines the current to the outer layers and the effect is more accentuated the higher the permeability of the steel. This high current density near the surface results in a high temperature rise and still greater ohmic resistance. It has been found that vastly improved characteristics result from the use of an outer skin drawn or laid over the steel conductor; such layer need not necessarily be of copper, but it should be a non-magnetic metal. This envelope will carry the current which is forced into the outer layers by the magnetic effect in the core, but its use brings the cable into the class of composite materials.

Copper-Clad Steel

Since the physical constants of copper and aluminium do not permit of these metals being strung upon the longest spans without the use of very high towers, and since the electrical properties of steel are still more unsatisfactory, there is reason to believe that future transmission lines will be very largely strung with composite conductors. Copper-clad steel was the first of these to attain any extended use. The conductor consists of a central core of steel surrounded by an annular jacket of copper. The method of manufacture involves casting or driving the copper jacket around the steel in the wirebar stage, all subsequent operations being made upon the compound material. It is claimed that the copper is actually welded to the steel, forming an alloy at the junction of the two. Copper-clad is not, nor is it claimed to be, an economical competitor of copper for long distance transmission because for a given conductance it is necessarily more expensive by the cost of the steel and the operations involved. Moreover, the method of manufacture requires that the percentage of steel to the total area shall be large, and for this reason the reactance will be undesirably high. However, this is partly balanced by the fact that due to the higher tenacity and the smaller sags the wires could be more closely spaced.

Two grades of copper clad steel are commonly used, known as 30 and 40 per cent., these figures being the conductance as related to annealed copper of the same size. It is usual to neglect the steel in conductance calculations and these figures therefore represent the percentage of copper in the total cross section of the wire. For nearly every class of electrical work the 40 per cent. grade is specified, its resistance and reactance being lower than the 30 per cent. class, whilst the mechanical characteristics are very high.

Hemp-Core Copper

This need hardly be considered as a special type of conductor because it involves merely the substitution of a hemp strand for the middle wire of a seven strand cable. There will thus be only six wires carrying current, and the cable is 16 per cent. greater in gross cross section than the equivalent seven strand copper. The hemp core will elongate to any reasonable amount and the load is carried wholly by the outer wires. However, the hemp is inelastic to a certain extent, and does not contract to the same degree as it elongates; in certain instances deterioration of the core has led to distortion of the cable. One reason sometimes adduced for the use of hemp-core copper on very high voltage installations is that the increased diameter of the cable increases the effective disruptive voltage and reduces the liability of corona; on the other hand, deterioration of the hemp causes small nodules to project between the wires, and these have been found actually to act as discharge points for corona. In general it has been found that a superior form of conductor has been produced by discarding the hemp core and using instead a middle wire of medium drawn copper which is sufficiently annealed to elongate and transfer the stress to the outer envelope.

It should be mentioned that hemp or annealed cores are only used with seven wire cable. Where a larger number of strands is employed no such large proportion of the tension comes upon the middle wire and all the strands can be of exactly the same material and temper.

Aluminium-Steel

Following on the introduction of copper-clad wire, the attempt was made to cast an aluminium jacket around a steel billet in the same manner. The experiment was not successful because of the great disparity between the melting points of the two metals; however, the problem was solved

TABLE I.—PROPERTIES OF TRANSMISSION CONDUCTORS.

	COPPER		ALUMINUM	COPPER-CLAD		ALUMINUM-STEEL			STEEL		
	Annealed	Hard Dr		30%	40%	7 Strand	37 strand	61 strand	Siemens Martin	High Strength	Extra High Strength
Conductivity %	100	97	60	30	40	52	49	53	8.8	8.6	8.4
Density	8.89	8.89	2.70	8.10	8.20	3.49	3.73	3.35	7.85	7.85	7.85
Expansion Coeff. °C.	17×10^{-6}	17×10^{-6}	24×10^{-6}	12×10^{-6}	12×10^{-6}	198×10^{-6}	193×10^{-6}	207×10^{-6}	12×10^{-6}	12×10^{-6}	12×10^{-6}
" " °F.	9.5×10^{-6}	9.5×10^{-6}	13.3×10^{-6}	6.7×10^{-6}	6.7×10^{-6}	11×10^{-6}	10.7×10^{-6}	11.6×10^{-6}	6.7×10^{-6}	6.7×10^{-6}	6.7×10^{-6}
Melting Point °C.	1100	1100	655	1100	1100	655	655	655	1360	1360	1360
" " °F.	2012	2012	1210	2012	2012	1210	1210	1210	2480	2480	2480
Annealing Point °C.	750	750	400	750	750	400	400	400	850	860	860
" " °F.	1380	1380	750	1380	1380	750	750	750	1580	1580	1580
Tensile Strength (min.) lbs/sqin	32000	56,000	24,000	80,000	75,000	51,600	58900	47,100	75,000	125000	187.000
" " max " "	36,000	64,000	32.000	97,000	97.000						
Elastic Limit min " "	27,000	34000	17 000	48,000	45.000	33400	37600	30800	38000	69000	112.000
" " max. " "	29,000	38,000	22,000	58.000	58000						
Modulus of Elasticity " "	12×10^{6}	16×10^{6}	9×10^{6}	21×10^{6}	19×10^{6}	12.5×10^{6}	13.4×10^{6}	12×10^{6}	29×10^{6}	29×10^{6}	29×10^{6}
Elastic Limit % of Tensile Str.	82	60	70	60	60	65	65	65	50	55	60
Specific Resistance, microhms-cm.-cu	1.724	1.755	2.874	5.90	4.42	3.33	3.49	3.23	19.9	20.4	20.8
" " " in cu.	.678	.691	1,130	2.32	1.74	1.31	1.38	1.27	7.85	8.04	8.20
Resistance Temp. coeff. °C.	.0039	0039	0039	0044	.0044	0039	.0039	0039	.005	.005	.005
" " " °F.	.0022	0022	0022	.0024	0024	.0022	0022	.0022	.0028	.0028	.0028
Ohms per mil. foot	9.52	9.81	15.90	31.80	23.80	18.30	19.45	18.00	108.00	111.00	113.40
Weight: 1000 c.m. 1000 ft. lbs	3.02	3.02	0.92	2.76	2.78	1.185	1.27	1.14	3.66	3.66	3.66
Relative weight for equal resistance	.97	1.00	.49	2.95	2.24	.735	.831	.69	9.75	9.95	10.20
" section " " "	.97	1.00	1.62	3.83	2.42	1.87	1.98	1.83	11.00	11.30	11.55
" diameter " " "	.985	1.00	1.27	1.80	1.56	1.37	1.41	1.35	3.32	3.36	3.40

These figures refer to wires from No. 6 to No. 14 B&S, Temp. 20° C.

by a more simple device. It was found to be not only practicable but entirely satisfactory if the individual aluminium wires were laid up around a steel core in an ordinary stranding machine. The steel wires are generally double galvanized and as there is little difference between the electro-positive properties of aluminium and zinc there is little or no opportunity of electrolysis as long as the galvanizing is intact. It is not absolutely necessary, but it is usual for the ordinary stranding scheme to be carried out; that is, in a seven wire cable the middle one will be of steel (sometimes seven small steel wires having the same total area) and the outer six of aluminium. In a thirty-seven or sixty-one wire cable the centre seven will be of steel. The ratio of steel to aluminium, therefore, is not always the same, and the properties of the compound conductor have to be calculated for the particular ratio in use.

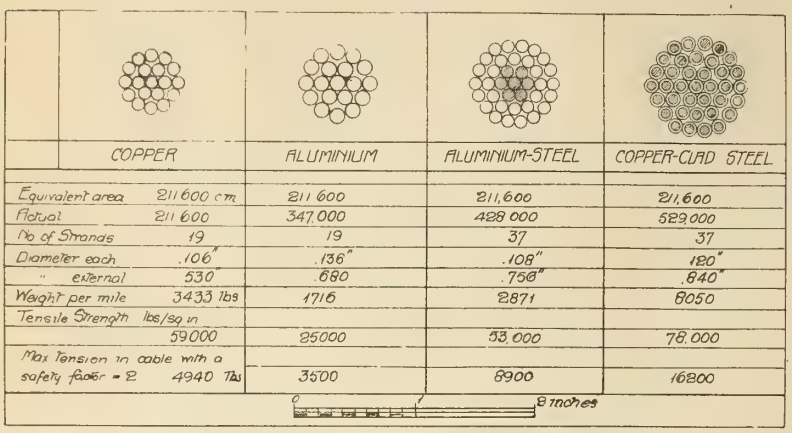


Fig. 1—Comparison of different transmission conductors, 4/0 equivalent

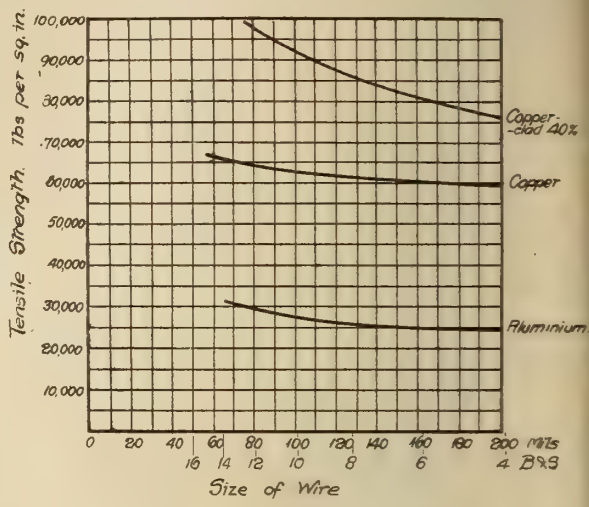


Fig. 2—Tensile strength of wire.

Aluminium Alloys

The maximum tensile strength of hard drawn copper wires as ordinarily used for transmission work is 60,000 lbs. per square inch, whilst that of aluminium in the pure state is about 30,000 lbs. When alloyed with a small percentage of copper or nickel the tenacity of aluminium can be increased by fifty per cent., and this has seemed to represent a more satisfactory solution of the problem of stringing long spans than the use of pure aluminium. A special alloy used for long span transmission work in Norway had the composition Al, 97.35, Cu. 1.85. The tensile strength of this wire is 42,000 lbs. per square inch and the elongation 5 per cent. on 2 inches. However, certain grave disadvantages attend the use of this material. Very simple tests have shown that destructive corrosion takes place under ordinary atmospheric influences. In addition to this the conductance is only 50 per cent. that of soft copper, whereas pure aluminium gives 60 per cent.; in other words, the alloy wires must be 20 per cent. larger and, due to its greater density, probably 35 per cent. heavier than the equivalent pure metal. In its advantages it is on a par with aluminium-steel, but it will be more costly and more liable to give corrosion troubles.

Bronze

This metal has attained little vogue in America, but is employed to some extent in Europe, particularly for river crossing spans, there being a certain amount of prejudice against the use of steel wires in this connection. The permissible tension may be considerably higher than is the case with copper, depending upon the percentage of phosphor and silicon. The material generally used has a tensile strength of from 70,000 to 110,000 lbs. per square inch, the conductance is generally less than half that of pure copper, however. Obviously this alloy is restricted in its use to such circumstances as call for tensile strength of a high order without regard to conductance. No advantage would be gained by stringing long transmission lines in bronze because 50 per cent. conductance would call for an increase of 100 per cent. in weight, which would only just be balanced by the 100 per cent. increase in tensile strength. Moreover, there is always a certain risk of crystallization in using alloys on long spans, with their inevitable oscillations, and it is unlikely that even in Europe will any further installations be strung with alloys of this nature.

All the various conductors available for transmission have been briefly summarized above, and in Table I. will be found the properties, corrected from the most authentic sources, of all those whose characteristics are reasonably satisfactory in the light of our present knowledge of the subject. Nothing can show more clearly the relative advantages and disadvantages of the various conductors than a comparison of their properties in the table. It would appear that the simple materials, copper and aluminium offer the best advantages from the electrical standpoint, but that the compound conductors, copper clad and aluminium steel give the best compromise between electrical and physical properties. The full value of high tenacity conductors is not seen until the problem of sags and heights of tower are considered. In Fig. 1 are shown four entirely different types of conductor, all equivalent to 4/0 copper; their sizes and other properties are therefore all compared on the basis of equal conductance.

The second article of this series will appear in our issue of February 1, and will deal with "Sag and Span Problems."



Household type Northern Electric dishwasher.



X-Ray view of washer.

New Cars for the Sandwich, Windsor & Amherstburg Railway System

A number of cars with Kuhlman standard steel-frame bodies, "Renitent" post construction and plain arched roof, and arranged for single-end operation, have lately been placed in service on the lines of the Sandwich, Windsor & Amherstburg Railway Company, of Windsor, Ont.

As will be seen by the floor plan, the cars are for single-end operation, and have a smoking compartment at the forward end. The total seating capacity is 46, ten being accommodated by longitudinal seats in the smoking compartment.

The end frame is made up of 5 by 3 by 5/16-in. angle side sills, open box type end sills made of No. 12 United States gauge steel, approximately 12 inches in width, having flanges turned on the bottom and riveted to the side sills; the crossings consist of 3-inch I-beams attached to the bottom flange of the side sills; the bolsters are of the built-up open-truss form. The platform framing consists of 7 by 3½ by ½-in. angle outside knees and drawbar sills of 5 by 4 by ½-in. angle; the latter extended from the face of the bumper to the end sill.

The entire side of the cars, together with the side sill angle, forms a girder which transmits the entire load to bolsters. An angle top-plate of 3 by 3 by ¼ in. and a plate-rail of pressed shape are secured to 2 by 1½-inch posts. Side plates of 3/32-inch steel are applied in three sections to a side. The letter-panel plate is of ⅛-inch pressed steel.

The roof is of the plain arch type and of the form known as the Kuhlman "true radius" pattern. The roof frame consists of angle top-plates with the horizontal leg turned in, steel carlines with a foot forged at each end for riveting to the vertical leg of the top-plate.

Open bulkheads forming an arch at each end of the car have pipe stanchions and railings which serve as grab handles. These bulkheads, and other parts covered with wood, are finished in quarter-sawed white oak. The headlinings are of composition material and the side and end wainscoting is of sheet steel. A partition of quarter-sawed white oak separates the smoking compartment from the main compartment and is fitted with a swinging door. Both sides of the partition and the door are glazed in the upper parts. A smaller partition, with door placed diagonally, forms the motorman's cab on the front platform.

The window posts are of the Brill "Renitent" type with spring brass casings. All the side window sashes, with the exception of one at the centre which is fitted with a destination sign, are arranged to raise their full height and have wire screen guards attached to the bottom rail of the sashes, which guards are concealed in pockets in the side walls when the sashes are in the lowered position. The upper sashes are stationary and are framed in a continuous piece. Brill

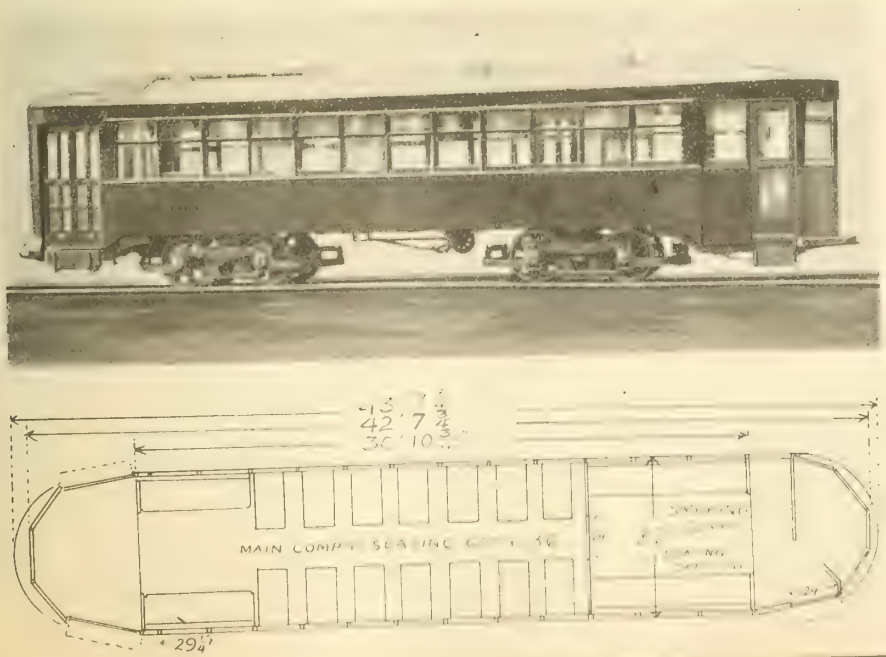


Interior new S. W. & A. cars.

stationary-back seats upholstered with canvas-lined woven rattan, are employed in the main compartment, and longitudinal seats of the same manufacture are used in the smoking compartment and at the rear of the main compartment.

At the front end the door of the sliding type, operates in unison with the folding step, and is controlled by manually operated devices from the motorman's position. The rear doors are of the double two-leaf folding type, hinged to fold at each side of the door opening, and operated by a pneumatic device from any point in the car, or from either platform.

The cars are mounted on Brill 51-E1 trucks with wheel base of 4 ft. 6 ins. and 33-in. wheels. These trucks have Brill solid forged side frames.



Steel construction, designed for single end operation on Sandwich, Windsor & Amherstburg Railway System. Total seating capacity 46. For city and suburban service.

The Dealer and Contractor

The Ontario Hydro Issues Amendments to Their Rules and Regulations—Will Standardize 660 Volt Key Sockets

We reproduce below a copy of amendments recently approved by Order in Council, to the Fourth Edition of the Rules and Regulations of the Hydro-electric Power Commission of Ontario. It is interesting to note that the Commission has ruled that the word "approved," when used in connection with compensators, is interpreted to mean that they must be provided with "no-voltage release." The Commission has also instructed the Inspection Department to take steps to standardize 660-volt key sockets as quickly as may be possible.

The following amendments of the Rules and Regulations, Fourth Edition, have been made and approved by Order-in-Council:

Clause (e), Page xii, Preface:

e. Electrical contractors, wiremen or other persons about to carry out any installation work must notify the Commission. The notice must be in writing on the form provided for the purpose by the Commission and must be accompanied by the amount of the fees in accordance with the "Schedule of Fees" published herein.

Add a new rule h. on Page xii of the Preface to read as follows:

h. No new installation, alterations or additions shall be connected to any service or other source of electrical energy to any service or other source of electrical energy by any supply authority, an owner of premises or by any other firm or person until the work has been duly inspected and a certificate issued authorizing the supply of electrical energy.

Change first rule on page xiii of the Preface from rule h. to rule i.

Page 18. A.C. Motors.

Commencing at the semicolon on the 4th line of the first paragraph under this heading and going down to the words "starting position" at the end of the sentence, rewrite, as follows:

"Where it is necessary to fuse the circuit beyond this limit and in sizes up to and not including 5 h.p. they must be started with an approved form of double-throw switch (unless some different but equivalent device be used) plainly indicating the starting and running sides and so constructed that a switch cannot be thrown on to the running side without first being put on the starting side, and so that it cannot be accidentally left in the starting position."

Add a new paragraph under rule f., Page 26, to read as follows:

Fuse holders must not be filled with other than approved fuses of the proper carrying capacity or must not be bridged with wire or other objectionable material.

Page 51.

Replace the 2nd paragraph of the explanatory note under rule (a) with the following:

"Except where permission has been granted to the contrary, the arrangement of cutout and switch must be such that the service wires first enter the latter."

In Rule (g), Page 54, strike out the words "not less than ¾ in. internal diameter and must be," and add the following as an explanatory note:

"Owners and others are strongly urged to call for not less than ¾ in. service pipe so that larger service wires may readily be drawn in at some future time should the introduction of electric ranges or other apparatus necessitate the provision of such larger wires."

Add the following note to Rule (i), Page 73:

"Special permission may be given for the use of varnished cambric insulation in dry or other suitable locations."

Amend Rule (c), Page 76, by striking out the period at the end of the rule and adding the following words:

"Or approved double-braided, rubber-covered conductors may, in certain permanently dry locations be used in conduit, under special permit in writing from the Commission."

Take out the whole of Rule (b), Sections 1, 2 and 3, on Pages 87 and 88, and replace it with the following:

"The supply for electric emergency lights must be taken either from a source separate from that furnishing other electric service in the building, or else it must be taken from a point on the generator side of the main cutouts or circuit breakers, used for other purposes of supply from the same source."

Where electric emergency lights are used, it is desirable that these be fed from a source of supply entirely separate from that used for other purposes.

Such a source may be outside or it may be a generating plant or storage battery inside the building.

If a separate source be not available then the supply for electric emergency lights must be taken from the generator side of the main service cutouts.

In every case emergency lighting circuits must be provided with their own cutouts.

Under no circumstances must emergency lighting circuits be used to supply current to anything but the **"emergency lights."**

By "Emergency Lights" is meant exit lights, and all lights in lobbies, stairways, corridors and other portions of a theatre to which the public has access, which are normally kept lighted during a performance.

Replace Rule (e), Page 88, with the following:

"Must be of the dead-front type and made of incombustible, non-absorptive insulating material. Plans of each board are to be approved before installation."

The whole section under the caption of "Moving Picture Equipments" is stricken out and the following clauses inserted under a new caption, "Moving Picture Booths."

w. 1. Conductors to moving picture machines must in no case be less than No. 6, B. & S. gauge copper wire.

2. The location and approval of rheostats to be under the control of the Inspector of Moving Picture Theatres, but all wiring and installation rules in connection therewith to be under the Hydro-electric Power Commission Inspection Department.

3. Cutouts and switches inside the booth must be of an approved type and so designed and installed as to eliminate possibility of shock or danger from fire.

4. All lamp cord to be approved reinforced cord and provided with wire guards and weatherproof sockets.

5. No open wiring will be permitted except leads to lamps and apparatus.

6. All other details of electrical construction must conform to such rules as apply.

After Rule (e), Page 102, to read as follows:

"Wires may enter buildings through incombustible, non-absorptive, insulating bushings sloping upwards from the outside or through conduit as required for electric light service (see Rule (g), Page 54)."

After Rule (b), Section 3, Page 121, to read as follows:

"Ground connections must be at the transformers and must also be made at individual services inside buildings when required by the Commission.

"When transformers feed systems having a neutral wire, such wire must also be grounded at least every 500 feet."

New Code Rule will Require Polarized Wiring

At the recent meeting of the Electrical Committee of the National Fire Protection Association for revision for the next edition of the National Electrical Code, it was voted to change Rule 26a as follows:

"The neutral conductor of all three-wire circuits and one conductor on all two-wire circuits must have an identifying insulating covering readily distinguishing it from other wires. This wire must be run without transposition throughout the entire installation and properly connected at all fittings to properly identified terminals in order to preserve its continuity. When one of the circuit wires is to be grounded, the ground connection must be made to this identified wire and as prescribed in Rule 15 and 15A."

This rule will appear in the new edition of the Code, to be known as the 1918 edition, and does not become effective until January 1, 1919. All fittings having wire terminals, such as sockets, receptacles, cut-out bases, attachment plugs, etc., must have some identifying mark to enable them to be easily connected with the proper terminal. Therefore, the organization known as the Associated Manufacturers of Electrical Supplies has submitted the matter to members of all of its sections covering the devices affected, asking that proper committees be appointed to consider the matter and report results at as early a date as possible, in order that they may be fully prepared for the new order of rules when in effect January 1, 1919.

Contractors Co-operate and Succeed

An excellent example of the fruits of co-operation is shown in the splendid Christmas advertisements of the Telephone City Electric Club, one of which is reproduced herewith. This was a full-page spread in the Brantford Courier and, occupying such prominent space, would naturally attract the attention of every reader of this paper. It is one of the best possible examples of what unified action among electrical dealers might accomplish. By such an arrangement the central idea is "electrical" gifts instead of any particular firm's name, which would necessarily be the case with individual announcements.

The fact of the matter seems to be that, until the electrical industry becomes more firmly established in the minds of the average citizen as an economical essential rather than an expensive luxury, we should all concentrate our efforts in educating the public to **think electrically.** This will require quite a good deal of newspaper space and no little shouting—but if we go out and shout one at a time there is much less likelihood of being heard above the noise of our competition in other lines of trade than if we all shout together and make a real noise. This may not be necessary in an established industry, but, as yet, it is very necessary in the electrical retail business. In the older industries it must be remembered that this work of education has been going on for a long time, but even now is being continued by the larger interests in the trade who have accumulated the necessary funds to act independently; the little fellows, of course,



Reproduction of full page advertisement.

profit at the big fellows' expense. But in the electrical retail industry the big fellows either have not yet come into existence or they have failed to accept their responsibilities of advertising for the whole trade and so it falls on the rank and file. Since these are not strong enough individually to make the big noise, it follows that they must act collectively, and this just brings us back to what the Brantford dealers have been doing for some time. There are only six of them and even if every one were, individually, to put his little advertisement in the paper, the chances are they would attract a very secondary attention. United in full page spread, however, they were sufficiently in the limelight to make electricity and electrical devices the centre of considerable attention and inquiry during the recent Christmas trade.

Toronto Electrical Contractors' Dinner—Jan. 10

The first meeting of the new year of the Toronto Electrical Contractors' Association, will be held at the usual place—Carls-Rite Hotel—on Thursday evening, January 10th. By the advance sale of tickets it is assured that practically every member will be in attendance at the dinner.

The members are going to run this meeting. If you have discovered a more convenient or a better method of doing certain work you will have your chance to tell it at the meeting. If you have ever struck a snag, electrically, bring along your problem. There will be a blackboard handy. If you have no new ideas, come along and get some.

The G & W Electric Specialty Company of Chicago have recently issued a quick reference list of their potheads and boxes. This list is a supplement of their catalogue No. 9, and will be found of great use to engineers and others in making up of specifications, etc. The list may be obtained from the following G & W representatives:—Bentz-Richardson Co., Ltd., Winnipeg; General Supplies, Ltd., Calgary and Edmonton; A. H. Winter Joyner, Ltd., Toronto and Montreal.

Some Observations on Lighting Conditions

By Geo. G. Cousins*

From the very beginning of the history of the human race man has endeavored, by the most suitable means at his command, to lengthen his period of daily activity beyond the limits of daylight. This after-daylight activity may take the form of work or recreation. Whatever form it takes is dependent upon artificial light, which is, by the very nature of it, man's creation, and is produced and used in various ways, governed by the ideas, knowledge, and requirements of different individuals. Never before has there been such an unlimited variety of appliances for facilitating the application of artificial light, and never before has there been such extensive use of or economical production of it.

Keeping pace with this advancement is the appalling increase of defective vision. Just how much the use of artificial light has to do with defective vision is not easily stated, but it cannot be denied that it is one of its principal causes. Of late years much has been learned of the relation of light to vision, and artificial light and its effects have been very thoroughly analyzed, and considerable publicity has been given to such analysis; and yet, in spite of this, there continues the harmful use of light such as may be seen on every hand.

The first requirement of artificial lighting is utilitarian in its nature, but the esthetic enters very largely into many classes of service, and in many cases is given undue weight, to the detriment of the former. Bad lighting conditions are looked upon by many as necessary evils; by many others all artificial lighting is considered more or less bad and harmful. A comparatively few realize that it can, when properly applied, be as comfortable and unharmful as daylight, and is much more flexible than the latter.

An observing person with any knowledge of the rudiments of illumination cannot fail to notice many of the faulty lighting installations that are altogether too common in our stores, factories, and public places of all descriptions. The good may also be noticed if we look for it; however, the bad is fairly thrust upon our attention by reason of the annoyance and physical discomfort caused by usually present glare or by the inability to see properly. The requirements of good illumination may be briefly stated as follows: That the proper amount of light of the proper quality be properly distributed. It is because of the last of these three factors that so many installations fall from the possible good to the actual bad. It is true that in some installations insufficient light is provided, but in the great majority of cases if the light generated by lamps was properly directed the resulting illumination would be fully adequate for good seeing.

Glare is the eyes' worst enemy. It has been spoken of as light out of place. When glare is present a higher average of useful intensity of illumination for possibly good vision is required than is needed when glare is absent or is so slight as to be unannoying. Glare is the worst offender in the illumination of public places.

A large proportion of those who cater to the public or endeavor to win patronage have a more or less hazy idea that light has some value in attracting people and consequently trade. The old slogan, "The crowd follows the light," does not necessarily mean that the crowd follows high-powered lamps. Many ridiculous installations of high-power lamps are the result of the misinterpretation of this slogan. If merchants would realize that it is not light, but the intelligent application of it, that attracts people, there would be a big change in the appearance of a great many store fronts and show-windows. Light has an enormous advertising value when properly applied so that the light-source itself is unobtrusive, if not invisible, and the outstanding feature of an installation is that which is being illuminated and not that which does the illuminating. A store front or show-window may be likened, to some extent at least, to the introduction to a composition of music. It makes a demand on our attention, and our impression of what follows is largely influenced by the first impressions made on us by the introduction. For this reason it is important that store fronts should be made attractive, and in order to make the most of window displays artificial light must be resorted to. The application of artificial light will make or mar the effectiveness of any display of merchandise according to the skill and knowledge entering into the solution of the problem.

A common example of the misapplication of light is shown by the following case: A well-kept, bright store is equipped so that the lamps installed to illuminate the show-window also furnish much of the illumination of the store. Above the plate glass window is a valence of diffusing glass, and behind this, placed close to the ceiling, are three 100-watt lamps, equipped with prismatic reflectors. This was the original installation, and showed that common sense had been used in planning it. However, in the centre of the window, at about the level of adults' eyes, is a gas-filled lamp (about 200 watt), equipped with a shallow mirrored reflector, so that the lamp filament is below the rim of the reflector. It is plain that this lamp was installed without the assistance of common sense. Whether one is on the inside or outside of that window, "safety first" demands that the eyes be turned away from this objectionable lamp. From across the street the window full of goods looks like an intensely bright lamp in the centre of a large frame. The resulting glare quenches any desire to examine the goods on display. If this application of light has any value it is a negative one, and defeats its own purpose. Several other installations of the same lamp and reflector, installed in the same way, were noticed in the same block, and it is at once clear that the neighborhood has been the victim of an energetic but ignorant salesman. This condition is not an isolated one, and is far too common even on some of our best business streets. In all probability, the time will soon come when such a condition will be prohibited by legislation. In the same class as this is the placing of arc and other high-power lamps in doorways and over the outside of show windows. It is inconceivable that business men, otherwise intelligent and quick to appreciate common sense, should permit themselves to inflict such outrages on the eyes of the public.

Indirect Lighting Could Be Used

Another class of offenders are the barbers who require their patrons, while being shaved, to gaze directly into a lamp equipped with a powerful reflector, located over the chair. The same reflectors turned upside down would eliminate the glare and still provide good illumination, provided that the ceiling received a little attention and white paint. The shadowless effect of indirect or semi-indirect lighting is a decided advantage for this class of service. It benefits both the shaver and the shaved.

In a certain city of fairly large size is a hall where many concerts and recitals are held. The interior is very attractively decorated, and is indeed a very pleasant place to enjoy a concert or recital, except for one serious fault. Sitting in the balcony and looking toward the stage one sees a bright lamp at each side of the stage, and just above the line of

* Hydro Laboratories, Strachan Ave., Toronto.

vision is the large central fixture, supporting translucent reflectors. A worse case of glare could hardly be imagined. It is a fairly safe guess that the architect or the man who planned the lighting never occupied a balcony seat during a performance. Patrons have found it necessary to shade their eyes with their programs or anything else at hand during performances. This condition could very easily be remedied by simply shortening the fixture suspending chains. From the main floor the central fixture is not objectionable, but the bracket lamps at the sides of the stage cause some annoyance. It is regrettable that such conditions exist in the face of such obvious remedy.

It is a very common practice to place lamps in brackets at the sides of concert platforms and church pulpits to light speakers, singers, or anybody who may be using the platform. It is rarely that such lamps are effectively shielded from the eyes of the persons in the auditorium, and the result is that glare is produced that tends to cause drowsiness, besides impairing the vision. In many cases the architectural features permit the use of concealed lamps to illuminate persons using the platform. If side lamps are desired for the sake of appearance, they should be of low power and well shaded by dense shades or globes.

The need for co-operation between architect and engineer is very much in evidence in churches. A typical example is that of a comparatively new edifice equipped with a row of fixtures along the centre, each supporting five bell-shaped translucent reflectors; brackets supporting two reflectors each are placed along the side walls. Members of the congregation complain of the lamps over the pulpit affecting their eyes, and members of the choir have to face a row of lamps just below the lower edge of the balcony. These defects may also be remedied by raising the fixtures in question, and, in this case, with no loss of useful light. In the ceiling of this church, on each side of the gable, is a row of large panels of light-colored glass. These would have provided an excellent opportunity to furnish a beautiful, soft-tinted light for use during the evening sermon and to supplement the main lighting during the opening and closing exercises by placing lamps with suitable reflectors in the peaks above the panels. The cost of such provision during construction of the building would have been very slight, but since the completion would, of necessity, be very much increased.

Intelligent Distribution Necessary

In lighting churches a common fault seems to be to equip the lamps with enclosing globes, usually decorative, in keeping with the scheme of architecture, but which do not appreciably improve the natural distribution of light from the lamps. Too much light is thus wasted on the walls, and the fixtures are hung low, so as to produce a sufficiently high intensity where it is needed, and, of course, the low height of such units causes glare.

Sometimes fixtures of good design and pleasing appearance are carelessly installed, with the result that the general appearance of the installation is considerably marred. Such is the case in a church equipped with semi-indirect bowls, adjusted so that the cut-off shadows on the walls form very uneven lines, because the lamps were not adjusted to a uniform position relative to the bowls. This is the only bad feature of an otherwise pleasing installation, and if the electrical contractor had any pride in his work, would soon see to it that it be eliminated.

The lighting of churches is not always a simple problem. The presence of balconies requires that the central fixtures be hung high, so as to keep the light sources out of the line of vision of occupants of the balconies. Beneath the balconies fixtures must be placed where head-room is usually very limited, and considerable skill is required in the selection and placing of units to avoid glare.

During the summer months the many feeble attempts to light bowling greens by a row of bare lamps suspended high enough to clear the heads of the men are good examples of illumination at its worst. All that can be said of bad illumination applies to installations of this class. Some of the money spent for energy and lamps invested in reflectors would make an enormous difference, and bowling under the improved conditions would be much more enjoyable.

The lighting of schools presents some interesting problems. Desks require illumination very similar to that of offices, but blackboards require very different treatment. It is often a rather difficult problem to illuminate blackboards properly so that chalk marks can be easily read from any part of the room. Fixtures used for the general room lighting are very often placed so that light from them is reflected specularly by the blackboard. In a certain modern educational institution this condition is very much in evidence in some of the rooms. Pupils are sometimes required to move from one seat to another to see work that is being done on a blackboard at the other side of the room from where he first sat. Such a condition is very likely to result in eye-strain, and every possible means should be resorted to to eliminate it.

Conditions in Industrial Plants

The foregoing cases are defects due principally to faulty design. There are other cases where illumination deteriorates through neglect. For instance, a hotel verandah is illuminated by lamps in prismatic stalactites which are nearly half-full of dead insects. This condition, aside from its bad appearance, reduces the resulting illumination very considerably. Examples of neglect are not by any means confined to artificial illumination. In large industrial plants where the work is mostly rough, the windows are usually sadly neglected, and it is often easy to count the number of windows that have been broken since the original installation. The worst that has ever come to the writer's notice is the machine shop of a cement plant. Here lamps were kept burning on bright, clear days, and were needed, too. It is no trouble to pick out otherwise well-kept factories whose windows absorb as much as 50 per cent. of the light, and yet superintendents would be insulted if told of this condition. There is probably no other factor that contributes so much to the quantity and quality of the factory output or to the welfare of the workers or that can be obtained at so little cost as daylight, and yet, until very recent times, has been sadly neglected. Modern factories are being put up that have plenty of window space, but if the windows are not kept reasonably clean there is a serious decrease in daylight illumination.

In this article attention is drawn chiefly to faulty conditions of illumination, the good being practically unmentioned. It is not the purpose, however, to exaggerate the former and minimize the latter. The examples cited are in actual existence, and are typical of the various classes of installations. The point to be emphasized is that such conditions are being duplicated over and over again. It is strange that electrical contractors or architects who plan the lighting of buildings are so unobserving or careless of their work that they do not return to remedy so many of the defects that may be so easily remedied.

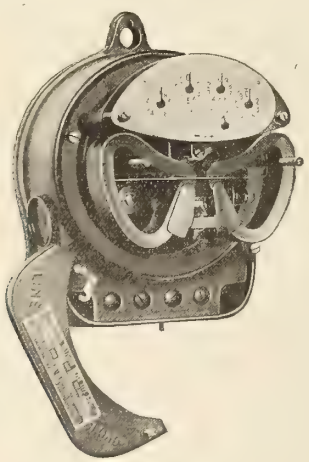
The Ontario Safety League have just distributed their third annual report for the year ending December 31, 1916. It shows that, during the year, the following distributions were made:—25,000 letters to drivers of vehicles; 83,000 school bulletins; 100,000 letters to parents; 62,000 industrial bulletins; 155,000 gummed seals; 4,000 sundry cards and bulletins; 5,000 cards to motorists; 2,000 traffic reports; $50 in essay prizes.

"Golden Glow" and "Crystal Mirror" Projectors

As a further development of their line of "Golden Glow" and "Crystal Mirror" flood-lighting projectors the Electric Service Supplies Company has placed on the market a new flood-lighting unit to be known as type FL-1419. This new type of projector is particularly designed for short range work where a wide beam dispersion is desired. They are equipped with 14-inch long focus type parabolic "Golden Glow" or "Crystal Mirror" reflectors, which project, respectively, powerful dispersed beams of rich golden light and white brilliant light. This company in their recent new catalog on flood-lighting projectors classified the different flood-lighting subjects in two divisions, namely, those in which the human eye is brought into continuous use to observe detail and those in which the human eye figures only momentarily or where lighting the subject as a whole is the main consideration. In the first classification they strongly recommend "Golden Glow" light, and in the latter case the white, brilliant light from "Crystal Mirror" projectors is desirable. This new type meets a demand for a more powerful projector than any heretofore cataloged by this company, it being adapted to use with 500 to 1500 watt type C Mazda (or nitrogen filled) lamps.

Watthour Meters

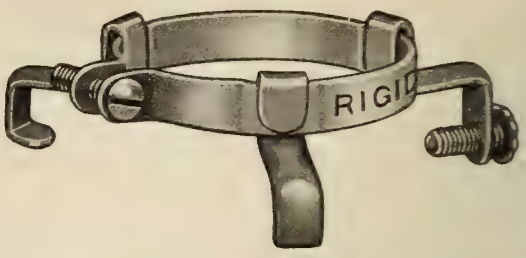
How often is it desirable to tear down and re-assemble a watthour meter? In answering this question it is difficult to make a definite statement as to the number of years a meter will operate accurately under the various conditions to which watthour meters are subjected. The average general practice in Canada, however, is to clean meters at least once in five years. In order to make the cleansing thorough, it is considered advisable to disassemble the meter frequently, clean and rebuild it. Then again, there are many conditions such as abnormal voltage due to surges, etc., also fires which damage meters to such an extent that it is necessary that they be overhauled. As this cleaning and overhauling is



desirable and necessary to maintain the meter's accuracy, its cost is an important factor in the operation of a meter department. Having this in mind, the Canadian General Electric Company's latest type of watthour meters have been designed having in mind their simplicity and accessibility. There is no particular order of operation to follow, to disassemble completely these meters, since the electrical damping and moving elements can all be removed independently of one another. Meters having such features can be torn down, cleaned and reassembled quickly and at low cost. These meters are also arranged with micrometer adjustments for full and light load and a ready means for inductive load compensation, which increases the speed with which they can be recalibrated after they are reassembled.

Duncan New "Rigid" Shadeholders

The Duncan Electrical Company, Limited, of Montreal, are now manufacturing a 2¼ in. "Rigid" Shadeholder for brass and porcelain sockets, which is of interest to the trade,



due to the fact that only one thumbscrew is needed to adjust holder on shade, as shown in accompanying illustration. This holder is made of very heavy brass, and when attached to socket is more "rigid" than any other holder on the market.

Trade Publications

C. G. E. Publications—Bulletin No. 46021, Curve-Drawing Ammeters and Voltmeters, Types CR and CR-2; Bulletin 68305-A, Safety-First Knife Switches; Bulletin 61401, Varying Speed Brush Shifting Motors; Bulletin 46013, Portable Instruments (Alternating and Direct Current); Bulletin 47469, Type FK-24, Oil Circuit Breakers.

Centrifugal Pumps—The Canadian Allis-Chalmers Limited, are distributing Catalog 1632-B, entitled "Centrifugal Pumps and Centrifugal Pumping Units." This is a valuable booklet of 50 pages, calling attention to the centrifugal pump for all classes of pumping service. It is well illustrated and contains many tables and curve charts.

Safety Panels and Cabinets—Bulletin No. 10, by the Crouse-Hinds Company of Canada, effective December 1, 1917, being supplement to Panel and Cabinet Bulletin No. 1, describing two types—the DPS, arranged for Edison fuse plugs in the branches, and the EPS arranged for N.E.C. cartridge fuses. This company are also distributing a folder, "Condulet Suggestion 35," concerning "Condulets" as applied to steamboat equipment.

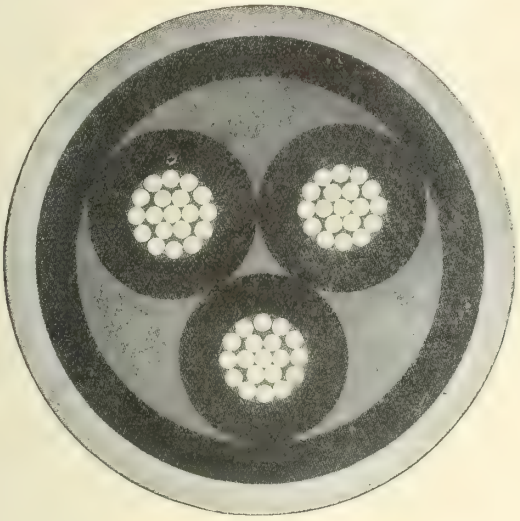
The Chatham, Wallaceburg and Lake Erie Railway system was forced to suspend their service recently on account of the shortage of gas, which they use to generate electric power.

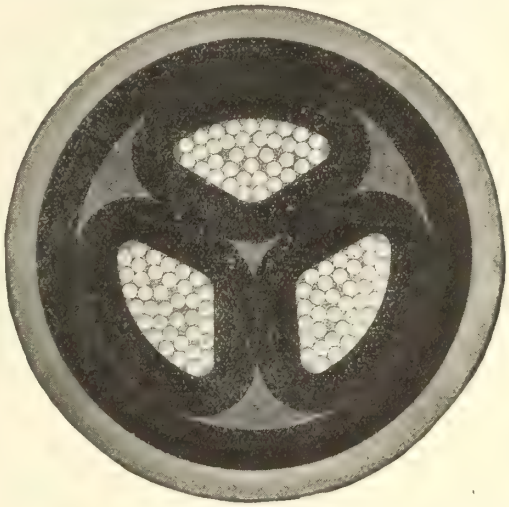
The Onward Manufacturing Company, Kitchener, Ont., have opened a branch office at 10 St. Antoine Street, Montreal. The new office will be in charge of Mr. O. W. Miessener, manufacturers' agent.

It is announced by the War Industries Board of the United States that formal assurances have been given Canadian authorities that the hydro-electric power at present being imported into the United States from Canada will not be used for any purpose other than the manufacture of war materials. In view of the shortage of power in the province of Ontario, which has handicapped some of our munition plants, it has been felt that the Canadian power at present being exported to the United States should be withheld in accordance with the agreement under which this power was originally allowed to go out of the country, namely: that it should be subject to recall on demand. In view of the fact that the extra power is wanted on both sides of the line for the same purpose, the Canadian Government is making every possible effort to meet the local demand without interfering with the munition industries across the line and it is on account of this that assurances have been given that Canadian power shall not be used for any purpose except to turn out war supplies.

PHILLIPS' CABLES

as supplied to the Toronto Hydro Electric System





These illustrations show cross sections in the original size of cables recently supplied to the T. H. E. System and reordered by them for further extensions. The specifications are as follows.—Conductors composed of 37 strands each, .082 in. diameter. Thickness of dielectric on each conductor, .210 in. Thickness in belt, .210 in. Thickness of lead sheath, .160 in. Overall diameter, 2.61 in., 250,000 C.M. Three Conductor, Paper Insulated, and plain Lead Covered Cable for 13,200 volts. We can supply you with wires and cables of any size for Power, Lighting, Telephone, Telegraph, etc.

Write us for detailed information.

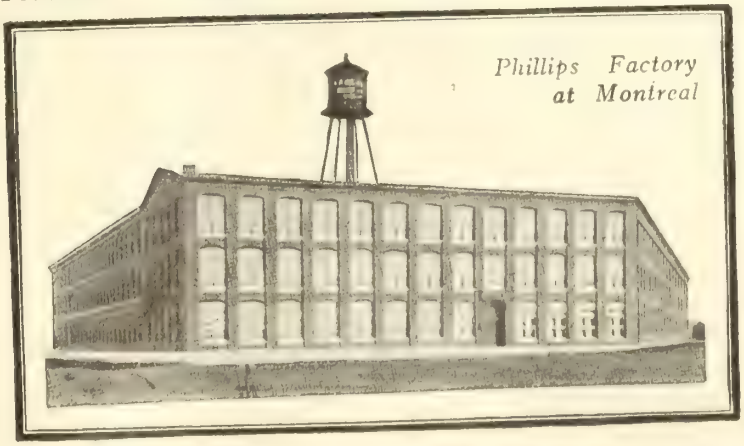
NOTE.—Specification of cable in left-hand cut: 3/0 B. and S. Three conductor. Each conductor 19 strands, each .094 in. diam. Thickness of dielectric on each conductor, .21 in. Thickness of dielectric on belt, .21 in. Thickness of lead sheath, .15 in. Overall diameter, 2.60.

Specification of cable in right-hand cut: As stated in copy.

Eugene F. Phillips Electrical Works, Ltd.

Head Office and Factory: MONTREAL

Branches: Toronto Winnipeg Regina Calgary Vancouver



Phillips Factory at Montreal

Current News and Notes

Brantford, Ont.

The Electric Smelting Company, Brantford, Ont., have been granted a charter.

Chatham, Ont.

The annual report of the Chatham Hydro-electric System gives the number of consumers as 1,558—an increase of 252 over last year. The total revenue is $45,714, as compared with $28,544 last year.

Galt, Ont.

A bylaw has been passed in Galt, Ont., to raise $45,000 to pay for extensions to the city's hydro-electric system.

Hamilton, Ont.

The Barton Township Council will submit a bylaw to the electors authorizing an expenditure of $55,000 for the purpose of installing Hydro power throughout the township.

Two new transformers have been installed at Hamilton, Ont., which, it is anticipated, will entirely overcome the eccentric service experienced in that city during the recent past.

Ingersoll, Ont.

Considerable improvements are being made to the power plant of the Ingersoll Telephone Company, Ingersoll, Ont. New storage batteries are being installed as well as a mercury arc rectifier.

Kingston, Ont.

The 44,000 volt line from Napanee to Kingston, which will serve Kingston, has been completed.

Merrickville, Ont.

The Rideau Power Company, of Merrickville, has requested the Hydro-electric Power Commission to design and purchase the necessary high tension equipment for its power house, in order to supply power to the Commission.

Orillia, Ont.

The annual financial statement of the Orillia Water, Light and Power Commission for the year ending December 10th, 1917, shows that notwithstanding the decrease in rates which affected last year, the receipts from lighting increased $1,844. The ordinary power receipts show a decrease of $6,915, but this leaves out of account $68,622 received from the munitions factories, which goes to pay for the power purchased from the Hydro-electric Commission. So far the Commission has been paid $46,153. Under the arrangements any surplus remaining after the account is finally closed is to be returned to the factories interested. About $15,000 has already been returned and there is still about $10,000 in this account, which constitutes the greater part of the "accounts payable."

Parkhill, Ont.

The residents of Parkhill, Ont., recently carried, by a large majority, a by-law authorizing an expenditure of $12,000 for the installation of Hydro power.

Perth, Ont.

The municipality of Perth recently passed enabling and money by-laws by substantial majorities. It is proposed to raise $120,000 by municipal debentures and to purchase the local electric and waterworks plant from the present owners, the Canadian Electric and Water Power Company. The Commission propose building a 26,400-volt transmission line between Perth and Smith's Falls, in order to supply the town with power. It is proposed to change over the present generating stations and distributing systems from 133 cycles to 60-cycle equipment.

Picton, Ont.

The town of Picton recently passed a Hydro enabling by-law. The present lighting plant is steam-operated and is the property of the muncipality. It is proposed to close down the steam plant and change the distributing system over from two-phase to three-phase. The municipality also propose to instal a motor-operated centrifugal waterworks pump of 1,000 gal. per min. capacity.

Regina, Sask.

A bill designed to authorize the use of one-man cars in Saskatchewan was "killed" by the Legislature of that province.

Toronto, Ont.

To save power for manufacturing purposes the Toronto city council have authorized the cutting off of 273 lights until the month of April. Each light cut off represents a saving of $9.20 per annum.

The Ontario Hydro Commission is purchasing two 4,000 kv.a. synchronous motors to be installed at Toronto for power factor correction on the Niagara system.

Trenton, Ont.

The Ontario Hydro Commission propose to serve the towns of Picton, Wellington and Bloomfield, in Prince Edward County, by means of a 44,000 volt line from Trenton. A sub-station will be erected at Wellington, for serving Wellington and Bloomfield, and a 4,000 volt line will be built from Wellington to Bloomfield. A sub-station will also be erected at Picton to serve this town.

Vancouver, B.C.

The British Columbia Telephone Company, Vancouver, B.C., will commence shortly the laying of another submarine telephone cable across False Creek.

Amendments to city by-laws adopted by the Vancouver city council recently provide that jitney competition against the B. C. E. R. Company will be prohibited after April 1, 1918.

Whitby, Ont.

Construction work has begun in Whitby, Ont., on a track from the Grand Trunk main line station to the military hospital on the lake-front. This road will be the initial unit of Whitby's street railway system authorized by vote of the municipality in adopting the Hydro radial proposal from Toronto to Whitby.

Windsor, Ont.

Two new electrically-driven pumps are to be installed in connection with the Windsor water supply system. It is proposed to use Hydro power to drive the pumps and keep the present steam installation for auxiliary purposes. In order to relieve the load on the Hydro system in the evening hours, however, the steam pumps will be used for an hour or two.

Wellington, Ont.

The town of Wellington, Ont., has passed enabling and money by-laws, 202 for and 1 against. It is proposed to issue debentures for the sum of $10,000 for the purpose of buying out the existing system and remodelling it. The Niles estate, owners of the existing system, has agreed to sell to the town for the sum of $3,000.

If You Build Motor Driven Machines

Wagner, Quality



The motor should not be less in quality than the machine. And it should be exactly suited in characteristics and horse-power to give the machine the best possible performance.

You can get the **Wagner, Quality Motors** that will meet all these requirements. The experience of the Wagner Company in this direction, whether for very large or very small machines, will be valuable to you. The reputation of the **Wagner, Quality Motors** will help to sell and keep sold, your products.

Send for Bulletins 11013 and 11113.

Wagner Electric Manufacturing Company of Canada Limited - Montreal

Power Bldg., Montreal. 347 Adelaide St. W., Toronto.

535

NICKEL

Shot—High and low carbon
Ingots—Two sizes, 25 lbs., 50 lbs.
ELECTROLYTIC NICKEL—99.80%

Prime Metals for the Manufacture of Nickel Steel, German Silver, Anodes and all remelting purposes. Our Nickel is produced as Rods, Sheets, Strip Stock, Wire and Tubes

MONEL METAL

Reg. U. S. Pat. Off.

We are SOLE PRODUCERS of this natural stronger-than-steel, non-corrodible alloy.

Manufactured forms are Rods, Flats, Castings, Tubes, Sheets, Strip Stock and Wire.

SEND INQUIRIES DIRECT TO US

The International Nickel Co.
43 Exchange Place, New York

REFLEX Spark Plugs



The REFLEX Line of Spark Plugs is a trade winner. They are made right—stay clean and keep the car on the go. A Gold Bond guarantee against defective material and workmanship is given with each plug.

Every customer satisfied — profits sure—a good line to handle for winning the good-will of motorists and users of engines.

Get the "Reflex" Agency.

Write for full particulars.

Great West Electric Co., Limited
61-63-65 Albert St., Winnipeg, Man.

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TORONTO MONTREAL

LAMPS

NITROGEN and TUNGSTEN

Write for Lowest Cash Prices

High Efficiency Lamp Co.

414 Yonge Street - TORONTO, ONT.

PETRIE'S LIST

of New and Used

MOTORS

for Immediate Delivery

No.	H.P.	Phase	Cycle	Volts	Speed	Maker
1	50	3	25	550	850	Westg.
2	50	3	25	550	750	C. G. E.
1	40	3	25	550	750	C. G. E.
1	25	3	25	2000	900	C. G. E.
1	20	3	25	550	1440	J. & M.
2	10	3	25	550	750	C. G. E.
1	7½	3	25	550	1400	Westg.
1	7½	3	25	550	720	Westg.
1	7½	3	25	550	750	C. G. E.
3	5	3	25	550	1440	Excelsior
1	3	3	25	550	750	C. G. E.
1	2	3	25	550	1400	Excelsior
1	2	3	25	550	750	C. G. E.
1	1	3	25	550	1450	Excelsior
1	1	1	25	220	1450	Excelsior

Write Us for Prices

H. W. PETRIE, Limited

Front St. West - Toronto, Ont.

Draughtsman Wanted

Preferably one who has had experience with electrical work and power station lay out. Box 655, Electrical News, Toronto.

FOR SALE

Immediate Delivery

NEW MOTORS

10, 20, 30, 40 and 50 H.P.

25 cycle, 550 volt, 3 phase

Large list 60 cycle Motors,

New and used. All types and sizes.

100 K.V.A. 60 cycle, 550 volt, 3 phase C.G.E. Generator

Other sizes 50 to 200 K.V.A. 550 and 2,200 volt.

New and used

25 and 60 Cycle Transformers

4000 lbs. No. 8 Bare Copper

at less than market price

E. A. LOWRY

209 King. St. - GUELPH, ONT.

Salaries by Mail Encourage Thrift

After trying various experiments the Detroit Edison Company has adopted the plan of sending employees' weekly checks by mail to their homes, and is pltased with the result.

The pay-roll week ends on Wednesday night, and the pay checks are put in the mail on Saturday, so that they are delivered in the first mail on Monday morning.

Before the change was made it was necessary to use six or seven automobiles every pay day in order to reach the men. This was inconvenient as well as risky.

There are 3,500 employees scattered over a large area, and in some instances 40 miles from Detroit, and the difficulty of paying them promptly and easily by any other method than through the mail by check is obvious.

PROCURED IN ALL COUNTRIES

LONG EXPERIENCE IN PATENT LITIGATION

SEND FOR HAND BOOK

PATENTS

PHONE MAIN 2582

RIDOUT & MAYBEE

59 Yonge Street

TORONTO - - - - CANADA

NOTICE

Pursuant to Power Commission Act, 6 Geo. V, Chapter 19, Section 39, 1916, and amendments thereto, and the Rules and Regulations of the Hydro-Electric Power Commission covering the design and construction of electrical machinery, apparatus, appliances, devices, material and equipment for use in the generation, transmission, distribution or use of electric power or energy in the Province of Ontario, in connection with any electrical installation or wiring for electric light, heat or power, where the electric pressure delivered to or from the same exceeds 10 volts, manufacturers of, jobbers, agents and dealers in electrical machinery, apparatus, appliances, devices, material and equipment, and others interested are hereby notified that the Commission orders that on and after three months from date of this notice no such electrical machinery, apparatus, appliances, devices, material or equipment used, or to be used, as above, may be used or disposed of in the Province of Ontario unless and until the design and construction of same has been submitted to the Hydro-Electric Power Commission of Ontario, and approval of such has formally been obtained.

By order,

The Hydro-Electric Power Commission of Ontario

W. W. POPE, Secretary

Toronto, January 1, 1918.

The FISHER ELECTRIC CO.

43 Britain Street, TORONTO

New and Used Machinery

MOTORS GENERATORS

TRANSFORMERS

WRITE US WHAT YOU WANT TO BUY OR SELL

Large Stock Carried

3 Phase, 25 Cycle, 220 Volt MOTORS

Now Ready for Immediate Delivery

No.	H.P.	Make	Speed	Type
3	100	General Electric	550	K
1	50	Allis-Chalmers (New)	750	
1	50	General Electric	500	K
2	50	General Electric	750	K
1	50	Westinghouse .. (New)	730	CS
1	25	General Electric	750	K
2	10	General Electric	750	K
5	5	General Electric	1500	KT

Ready for Delivery in January

No.	H.P.	Make	Speed	Type
1	200	General Electric	750	K
1	150	Westinghouse	485	C
1	100	General Electric	500	K
1	100	General Electric	750	K
1	60	General Electric	750	K
3	35	General Electric	750	K
1	35	Westinghouse	1400	CCL
5	25	General Electric	750	K
3	20	General Electric	750	K
1	15	General Electric	750	K
6	10	General Electric	750	K
8	5	General Electric	1500	KT
11	3	General Electric	1500	KT
6	2	General Electric	1500	KT

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274 Commercial St. - BOSTON, MASS.

Mica Insulation

We manufacture everything, including:—

Tubes, Motor Rings, Washers,

Built Up Plate

Flexible-Mica Cloth and Paper

Raw Mica (cut or uncut) **Ground Mica**

Mica Company of Canada, Ltd.

P. O. Box 156, HULL, Quebec

Selections from Our Stock of Motors

3 PHASE, 60 CYCLE MOTORS

Qu.	H.P.	Make	Volts	Type	Speed
2	½	G.E.NEW...	110	KT	1800
1	1	Fbks. M. ..	440	B	1200
1	2	Wstgh.	440	CS	1120
1	50	G.E.	220	M	900
2	3	R&M NEW.	220		1150
6	3	Wstgh. New	220	CS	1130
1	3	Cr.Wh.	220		1720
1	3	Fbks.M. ...	220	B	1200
2	3	G.E.	220	KT	900
4	3	G.E.	220	KT	1800
1	3	G.E.	220	KT	900
2	3	G.E.	220	KT	1200
2	5	G.E.NEW. .	220	KT	1800
3	5	Wstgh. New	220	CS	1130
4	5	G.E.NEW. .	220	KT	1200
2	5	Wstgh.	220	CCL	850
30	7	G.E.	550		1200
1	7½-15	Cr.Wh..	220/440		865/1735
5	7½	G.E.NEW. .	220	KT	1800
4	7½	G.E.NEW. .	220	KT	1200
6	7½	G.E.	550	KT	1800
2	7½	G.E.NEW. .	220	KT	900
3	10	G.E.NEW .	220	KT	1800
1	10	Wstgh.	220	CCL	1700
1	10	Wstgh.	220	CS	1150
1	10	Cr.Wh. . ..	550	Q	1800
3	15	R&M	220		1150
4	15	Fbks.M.	220/440	KBV	1200
1	20	Cr.Wh..	220/440		1200
1	20	Triumph	220/440		900
2	20	Wstgh. . .	220	CS	1160
1	20	Fbks.M. . .	220	B	1200
50	20	Fbks.M.	220 440	KBV	1200
29	25	Wagner	220 440	BP	1120
1	25	G.E.	220	M	900
2	30	Wagner NEW	220		850
1	35	Triumph	220 440		900
1	35	G.E.	220	KT	600
1	35	G.E.	220	KT	720
1	40	Wagner NEW.	220/440	BP	850
1	40	Fbks.M. . .	220		900
1	40	G.E.NEW .	220	KT	1200
1	50	Triumph . .	220		720
1	50	G.E.NEW. .	220	KT	900
2	50	G.E.NEW .	440	KT	900
1	50	G.E.NEW..	220	KT	1200
2	75	G.E.NEW	220/440	K	900
1	125	G.E.	2200	L	600
1	150	Wstgh. New	440	CW	695
1	200	Wstgh. . .	2200	CCL	580
1	263	G.E. Synch. with direct connected exciter.....	2200		600

3 PHASE, 25 CYCLE MOTORS

Qu.	H.P.	Make	Volts	Type	Speed
1	5	G.E. . . .	220	KT	750
1	12½	G.E.elev.type-high torque	220	KTE	750
1	15	Wstgh. . .	440	CS	730
6	15	Allis-Ch. ..	220		750
1	15	Fbks.M. . .	440	B	750
7	20	Allis-Ch. ..	220		750
2	20	G.E.	440	K	750
6	25	G.E.	440	K	750
1	50	Allis-Ch. intermittent duty, sl. rg. drum controller	440		500
1	55	Wstgh.sl.rg. 30 cycles, complete. .	440		860
1	60 45 30	G.E.	440		500 375 250

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SECOND HAND 60 CYCLE MOTORS

1 30 H.P., 850 R.P.M., 220 V., 2 Phase C.G.E.
1—20 H.P., 850 R.P.M., 220 V., 2 Phase Westinghouse, CCL
3—10 H.P., 1120 R.P.M., 220 V., 2 Phase Westinghouse, CCL
2— 5 H.P., 1120 R.P.M., 220 V., 2 Phase Westinghouse, CCL
2— 5 H.P., 1720 R.P.M., 220 V., 2 Phase Westinghouse, CCL
1— 2 H.P., 1720 R.P.M., 220 V., 2 Phase Westinghouse, CCL
1— 2 H.P., 1720 R.P.M., any volt, 2 or 3 phase, Crocker Wheeler, to be wound.
3— 1 H.P., 1720 R.P.M., any volt, 2 or 3 phase, Westinghouse CCL, to be wound.
2—10 H.P., 1120 R.P.M., any volt, 3 phase, Westinghouse CCL, with Star Delta Switch.
1—20 H.P., 850 R.P.M., 220 V., 3 Phase Westinghouse, CCL
2—10 H.P., 1120 R.P.M., 220 V., 3 Phase Westinghouse, CCL
1— 5 H.P., 1120 R.P.M., 220 V., 3 Phase Westinghouse, CCL
1— 5 H.P., 1720 R.P.M., 220 V., 3 Phase Westinghouse CCL, rewound.
1— 3 H.P., 1720 R.P.M., 220 V., 3 Phase Westinghouse C, rewound.
1— 5 H.P., 1720 R.P.M., 220 V., 3 Phase Westinghouse,. C

25 CYCLE MOTORS

1—50 H.P., 750 R.P.M., 550 V., 3 Phase, Can. Gen, Elec, Form K,
1—60 H.P., 750 R.P.M., 550 V., 3 Phase, Crocker Wheeler.
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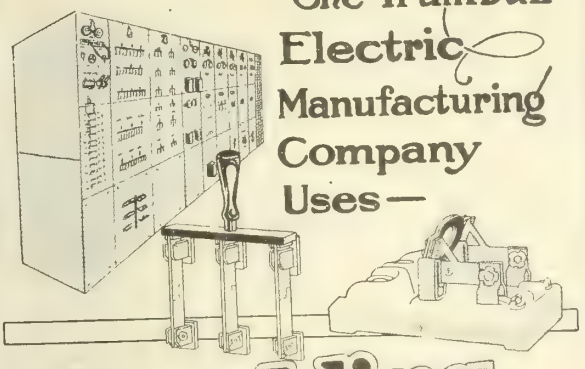
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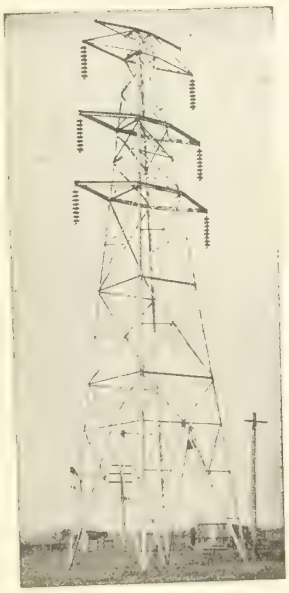
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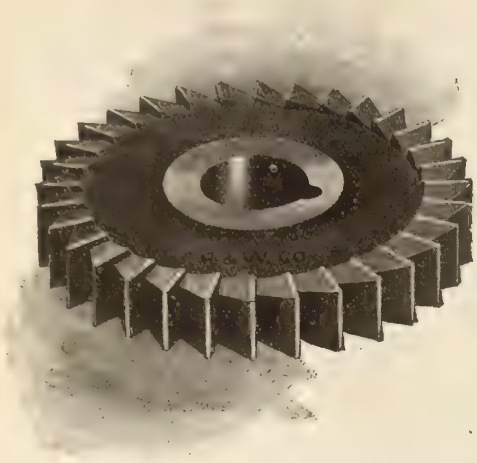
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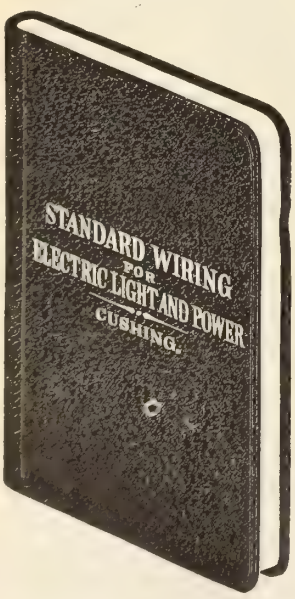
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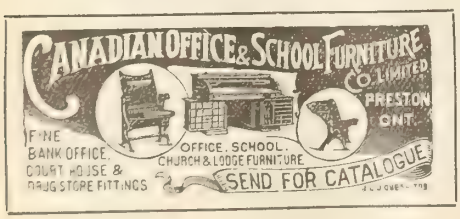
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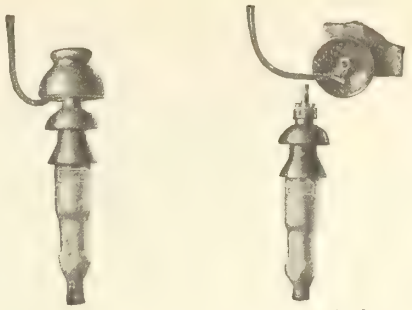
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Hatheway & Knott, Inc.

DETECTORS (Voltage)
G. & W. Electric Specialty Company

DISCONNECTORS
G. & W. Electric Specialty Company

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Gest, Limited, G. M.
See Directory of Engineers.

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National Electric Heating Company

ELECTRIC SHADES
Jefferson Glass Company

ELECTRIC RANGES
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National Electric Heating Company
Northern Electric Company
Standard Electric Stove Company

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Electric Service Supplies Company
Ohio Brass Company

ELECTRICAL TESTING
Electrical Testing Laboratories, Inc.

ENGINES
Boving & Company of Canada
Canadian Allis-Chalmers Company
Waterous Engine Works Company

FANS
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Canadian Westinghouse Company
Century Electric Company
Great West Electric Company
Northern Electric Company
Pringle, R. E. T.
Robbins & Myers

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Spaulding & Sons Company, J.

FIBRE (Vulcanized)
Spaulding & Sons Company, J.

FIRE ALARM EQUIPMENT
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Hatheway & Knott, Inc.
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Jefferson Glass Company
Northern Electric Company
Tallman Brass & Metal Company

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Canadian Westinghouse Company
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Daum, A. F.
Detroit Fuse & Manufacturing Company
D. & W. Fuse Company
Economy Fuse & Manufacturing Company
G. & W. Electric Specialty Company
Hatheway & Knott, Inc.
Moloney Electric Company of Canada
Northern Electric Company

(Continued on page 54)

Are you interested in the remarkable development which has been going on in the

I-T-E CIRCUIT BREAKER

during the past year or two?

The scope of our work enables us to supply **practically standard breakers for special service.** We submit that the circuit breaker art of the world is what we have made it. A search of the Patent Office records will prove this statement, or an easier way might be for you to look at any recent notable installation.

Take the Equitable Building in New York, for example, or the Lumber Exchange and the Conway Building of Chicago, or the wonderful equipment of the Ford Motor Company.

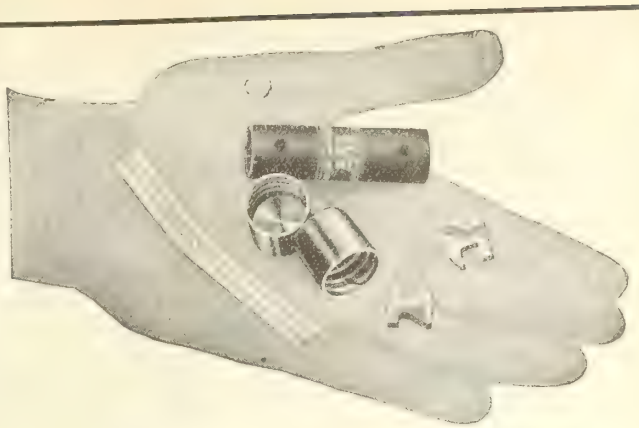
The Cutter Company

Traders Bank Building, Toronto, Ont.

Main Office and Factory: Philadelphia, Pa.

New York, 50 Church St.
Detroit, Mich., Ford Bldg.
Indianapolis, Ind., Telephone Bldg.
Chicago, Monadnock Block.
Pittsburgh, Park Building.
Minneapolis, Metropolitan Life Bldg.
ECCLES & SMITH CO.
Los Angeles San Francisco
Portland, Ore.

CIRCUIT I-T-E BREAKERS



TRADE AUM MARK **Renewable Fuses**

FOR ELECTRIC LIGHT AND POWER

Always were the simplest fuses in construction on the market. The new Type "B," Form 4, has been reduced to the fewest parts—four metal parts of solid brass, a fibre shell and the fuse strip. Caps are removed by a twist of the wrist and as easily tightened, holding the fuse strip in intimate metal-to-metal contact.

Free Samples If You Write Today

A. F. DAUM, Sole Mfr., **Pittsburgh, Pa.**



Notice the provision for ventilating a

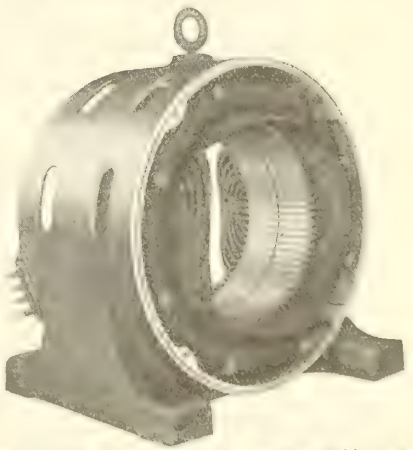
Century

Repulsion Start Induction

SINGLE PHASE MOTOR

The open ratings are based on a 40° Cent. temperature rise under continuous full load.

They Keep A Running



Illustrating the construction on the field of a 10 H.P., 60 cycle, 1750 R.P.M. Motor.

Century Electric Company

19th, Pine to Olive Sts., ST. LOUIS, Mo., U.S.A.

281

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Great West Electric Co., Ltd., Winnipeg
Rudel Belnap Machinery Co., Ltd., Can. Express Bldg., Montreal
Rankin & Cherrill, 55 Hastings St. W., Vancouver, B.C.

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Canadian General Electric Company
Canadian Westinghouse Company
Canadian Vickers, Limited
Electrical Maintenance & Repairs Company
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Lincoln Electric Company of Canada
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HYDRO EXTRACTORS
Jones & Glassco

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Redmanol Chemical Products Company

INSULATION (Hard Fibre)
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Mica Company of Canada
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Ohio Brass Company

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Northern Electric Company
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Steel Company of Canada, Limited
Steel City Electric Company

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Canadian General Electric Company
Joyner, Limited, A. H. Winter
Northern Electric Company
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LOCK AERIAL RINGS
Acme Stamping & Tool Works, Limited

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Sundh Electric Company

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Thompson-Levering Company

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Chamberlain & Hookham Meter Company
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Rose & O'Hearn

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Kent Bros.
Mica Company of Canada

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Canadian General Electric Company
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Canadian Vickers
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Lincoln Electric Company
Northern Electric Company
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Pringle, R. E. T.
Robbins & Myers
Thomson Company, Limited, Fred
Toronto & Hamilton Electric Company
Wagner Electric Mfg. Company of Canada

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International Nickel Company

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G. & W. Electric Specialty Company
McGill Manufacturing Company
Spielmann Agencies, Registered.
Standard Underground Cable Co. of Canada

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Electric Testing Laboratories, Inc.

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Pringle, R. E. T.

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Joyner, Limited, A. H. Winter
Northern Electric Company
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REPAIRS
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Cutter Company, Geo.
Duncan Electric Company
Monarch Electric Company
National Metal Molding Company
Northern Electric Company
Starr Son & Company, John

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Rubber Covered Wires and Cables

FOR POWER, LIGHT AND TELEPHONE WORK

Incandescent Lamp Cord, Flexible Switchboard Cables, Special Cords and Cables for all kinds of Electrical Work.

Prompt Shipments from Canadian Factory.

BOSTON INSULATED WIRE & CABLE COMPANY

Canadian Office and Factory, HAMILTON, ONT.

Transformers

Built to order

¶ With twenty-four years' experience, a modern factory, and a staff of specially skilled engineers, we are equipped to design and build transformers for special work.

¶ If you have an unusual transformer problem call on us.

Kuhlman Electric Co.

Bay City, Mich.

REDMANOL

"The material of a thousand uses"

THE ANHYDROUS PHENOL RESIN COMPOUNDS

They excel in
Heat Resistance—Dielectric Strength—Mechanical Strength—Accuracy of Dimensions
furnished in
sheets, tubes, rods, granular, molding plastic, impregnating liquids.

Write us for our catalog.

Redmanol Chemical Products Co.

676 West 22nd Street, CHICAGO

Tenders

A few dollars spent in advertising your proposals in

The Contract Record

would result in additional competition, which might save your city or town or your client many hundreds of dollars.

For Underground Work

BITUMINIZED FIBER CONDUIT

has properties not possessed by any other type of Conduit made, which recommends it particularly for Underground Systems of Distribution.

EASY TO HANDLE — LOW FIRST COST
EASY TO INSTALL — LOW INSTALLATION COST

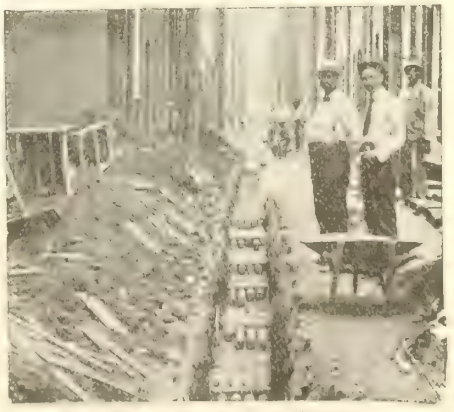
7 foot Lengths — ⅛ inch Wall — ⅜ inch Socket Joint
Absorption, 100 Hours, less than 1 per cent. — Puncture Test 50,000 Volts

Electrolysis-proof — Water-proof — Gas-proof

Write for literature

American Conduit Company

East Chicago, Ind., U.S.A. 140 Nassau St., New York City



Installing a Truck Line Subway

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Canadian Independent Telephone Company
Northern Electric Company

TOASTERS
National Electric Heating Company
Northern Electric Company

TOOLS
Northern Electric Company
Pratt & Whitney Company of Canada

TOY TRANSFORMERS
Killark Electric Manufacturing Company
Thordarson Electric Manufacturing Company

TRANSFORMERS
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Canadian Crocker-Wheeler Company
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Rose & O'Hearn
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Wagner Electric Mfg. Company of Canada

TRANSMISSION TOWERS
Canadian Bridge Company

TROLLEY GUARDS
Ohio Brass Company

TUBING
Northern Aluminum Company

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WASHING MACHINES
Connor & Son, J. H.

WATER POWER MACHINERY
Boving Hydraulic & Engineering Company
Smith Company, S. Morgan

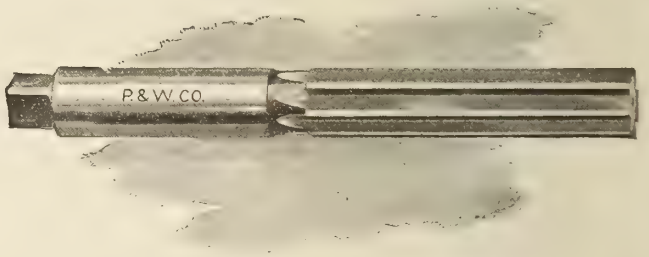
WATER WHEELS
Canadian Allis-Chalmers Company

WELDING EQUIPMENT
Lincoln Electric Company of Canada

WIRE
Boston Insulated Wire & Cable Company
Canada Wire & Cable Company
D. & W. Fuse Company
International Nickel Company
Northern Electric Company
Phillips Electrical Works, Ltd., Eugene F.
Standard Underground Cable Company of Canada, Limited.
Starr Son & Company, John

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Hatheway & Knott, Inc.
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Cutters Taps Dies Drills

P. & W. Co.

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Pratt & Whitney Co. of Canada, Limited

DUNDAS, ONT.

MONTREAL
723 Drummond Bldg.

WINNIPEG
1205 McArthur Bldg

VANCOUVER
609 Bank of Ottawa Bldg.

LINCOLN MOTORS

Your Customers Know Them

The man you have to deal with in any industrial plant will know Lincoln Motors.

The managers and superintendents of these plants have read about Lincoln Motors in their own trade and technical papers. They know the waterproof, dust-proof insulation—the simplicity of construction — the overload capacity and the other features that make Lincoln Motor drive a paying investment.

The Lincoln advertising campaign is boosting for more motor-driven plants —and more Lincoln Motors.

Speak to your customers about Lincoln Motors.

Write for Bulletin on Motors.

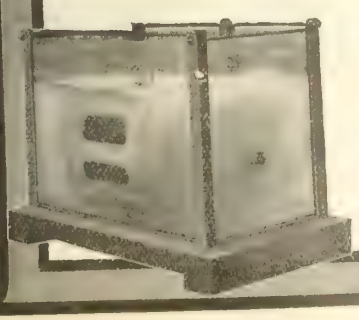
"Link up with Lincoln"

Lincoln Electric Co.

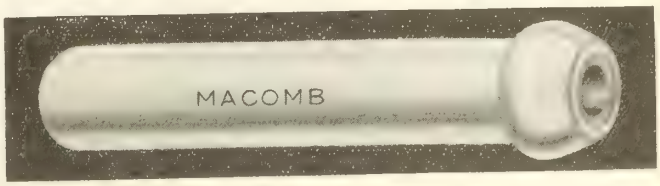
of Canada, Limited

Head Office
311-312 Kent Building
TORONTO
Ontario

Branch Office
MONTREAL



THE MARK OF QUALITY



ELECTRICAL PORCELAIN

Special porcelain of all kinds. In quality and design you will find our porcelain split knobs, standard knobs, cleats, tubes insulators, etc., unsurpassed.

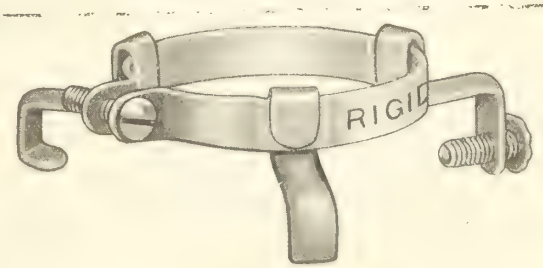
Send for Catalog

Illinois Electric Porcelain Co.

Macomb, Ill., U.S.A.

Toronto, Canada, 307-308 Tyrrell Building

New "Rigid" Shadeholder



No. 400

Only One Screw to Adjust

Made for Brass and Porcelain Sockets

In 2¼ inch only.

Packed 100 in a box—
Standard package 1000.

Manufactured by

The Duncan Electrical Co., Limited

1665 St. James St. - MONTREAL, QUE.

Westinghouse

Automatic Electric Ranges

The Westinghouse "Automatic Electric" is a full sized range large enough for any family, yet economical even when cooking for two. It revolutionizes cooking.

The time clock turns on the current at any hour set. The automatic thermometer turns it off when the ovens reach the desired temperature. Then the ovens use no more electricity, but continue to cook the meal with the stored up heat, like a fireless cooker.

The ovens are made to hold the heat, keeping it in the stove, instead of radiating it in the kitchen, or throughout the house.

Every part of the range can be kept sweet and clean. Everything can be instantly removed from the ovens, and the ovens, which are lined with rust-resisting metal, thoroughly scoured and dried. There are no inaccessible places for dirt or crumbs to collect.



Type 3-19B Full-Automatic Electric Range.



Type 2-19B Semi-Automatic Electric Range.

We also manufacture non-automatic electric ranges, and semi-automatic ranges in which the current is turned on by hand and an automatic thermometer rings a bell when the desired temperature is reached, as a reminder to turn the current off by hand.

There is not a more economical electric range than the Westinghouse, or one that is more convenient, substantial and durable.

Our nearest office will give further particulars.

Canadian Westinghouse Co., Limited, Hamilton, Ontario

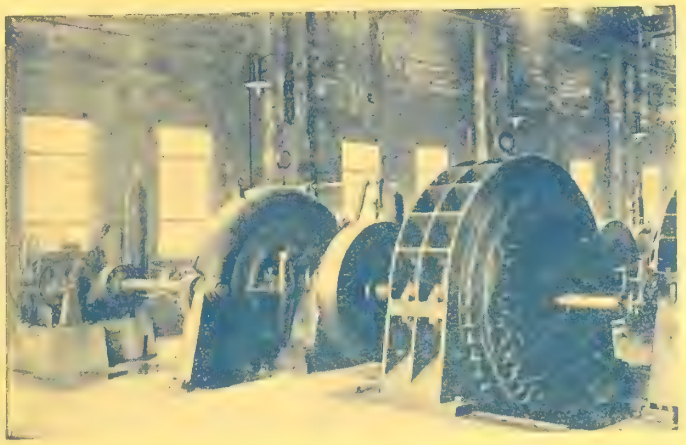
Toronto	Montreal	Ottawa	Halifax	Ft. William	Winnipeg	Edmonton	Calgary	Vancouver
Traders Bank Bldg.	52 Victoria Sq.	Ahearn & Soper Ltd.	105 Hollis St.	Telfer Bldg.	158 Portage Ave. E.	211 McLeod Bldg.	Grain Exchange Bldg.	Bank of Ottawa Bldg.

A Lost Opportunity

As a wiring contractor, how many times have you turned down orders to repair the Motors or dynamos of your customers and let them send their work to the maker?

How much have YOU lost in prestige through not being able to take care of your customers' business?

How much have YOU lost in Profit on this business?



Get the habit of handling these repairs. Send them to a **Specialist in Repairs.** Don't send them to the maker. Your customer can do that, and he's already sick of it. The service is too slow. He wants quick work and an absolutely reliable job. You can give it to him.

Make up your mind **now.** Say **"I'm going to get something out of the next repair job in this town."**

You have the work of taking out and re-installing the machine **(Profit).** Send us the machine or part with a description of its action or symptom. We'll rush it through for you, give you an A1 job and you come in again on the **Trade Discount (More Profit).**

Others are doing it. Why not you? Write about it.

The Electrical Maintenance & Repairs Company, Limited

Phones:
Adelaide 902
Adelaide 903

162 Adelaide Street West, Toronto
"ALWAYS ON THE JOB"

Nights and Holidays
R. B. Rothwell, Supt., Beach 1930
G. T. Dale, Manager, Beach 1723

JONES & GLASSCO
(REG'D)

ENGINEERS

MONTREAL AND TORONTO

Specialists in

POWER TRANSMISSION CHAINS

CANADIAN AGENTS FOR

"RENOLD"

Patent Silent and Bush Roller Chains

"MORSE"

Rocker Joint Silent Chains

CHAIN DRIVES FROM 1 4 H.P. TO 5000 H.P. IN SUCCESSFUL OPERATION

Write for particulars to

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MONTREAL

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1204 TRADERS BANK BUILDING
TORONTO

ELECTRIC REPAIRS

We can keep you running
while we make your repairs

FRED THOMSON CO., LIMITED

326-328-330 WEST CRAIG STREET
MONTREAL

G & W DETACHABLE POTHEADS

On Overhead Lines

Make Your Service Flexible



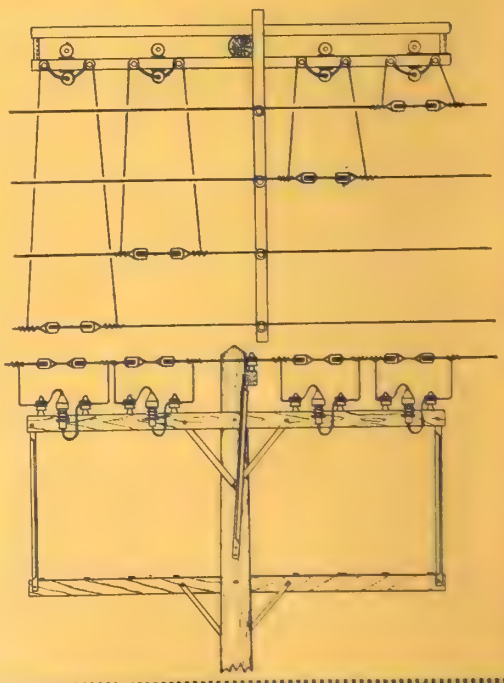


Every distribution system, large or small, needs a simple provision for sectionalizing and testing. Cutting wires entails expensive repairs and loss of revenue.

G & W Detachable Potheads enable you to test out the line, to localize a case of trouble, and to correct it in the shortest possible time.

In case of feeder trouble, Potheads may be used to connect the load to another feeder. The possibilities for manipulation of circuits are numerous. The simplicity and low cost of the G & W Pothead make it available where there is or may ever be an occasion for disconnecting. Its absolute reliability, ample carrying capacity and safe construction make it equal, in point of actual results, to any device that could be installed.

TRY THEM ON YOUR NEW CONSTRUCTION



G & W Electric Specialty Co.

7440-52 So. Chicago Ave., Chicago, U.S.A.

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A. H. Winter Joyner, Ltd., New Birks Bldg., Montreal, Que.
Bentz-Richardson Co., Ltd., 592 Notre Dame, Winnipeg.
General Supplies, Ltd., 112 11th Avenue W., Calgary, Alta.

Vol. XXVII No. 2 Toronto, January 15, 1918

Electrical News

Generation, Transmission and Application of Electricity

"Galvaduct" "Loricated"

The Ross Memorial



Ross Wing Royal Victoria Hospital, Montreal A "GALVADUCT" Building.

Architects: { Stevens & Lee, Toronto. Kenneth G. Rea, Montreal.

Contractors: E. G. M. Cape & Co., Ltd Montreal.

"GALVADUCT"

The most perfect interior construction conduit on the market.

Recognized as the standard of high quality.

Always specify Galvaduct or Loricated

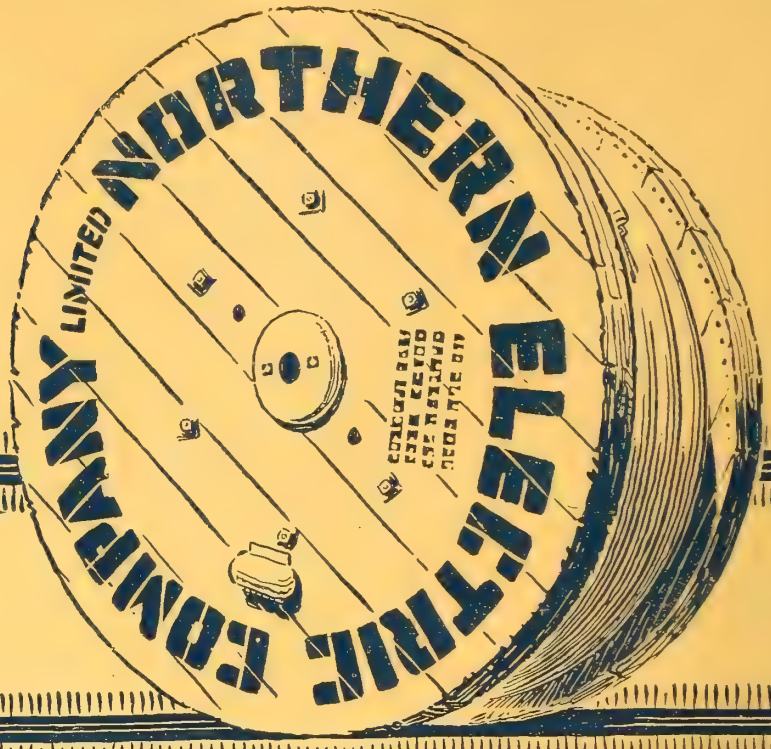
"LORICATED"

A high-class interior construction conduit of the enamelled type, proof against acid or other corrosive agents.

If your jobber cannot supply you—write us.

Conduits Company Limited, Toronto

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The Best Known Cable Reel in Canada

In Halifax or Vancouver, whether on the public thoroughfares of our larger cities or smaller towns, wherever there is a cable installation in progress, the reels invariably bear the name of the Northern Electric Company, Limited.

The installation may be overhead, underground or submarine. It may be for a Telephone Company, a Telegraph Company, a Railroad Company, or for a street lighting system.

The quality, both of the product and the service, is largely the reason for the universal demand for Wires and Cables of Northern Electric manufacture.

Northern Electric Company
LIMITED

Montreal
Halifax
Ottawa

Toronto
London
Winnipeg

Regina
Calgary
Vancouver

"Yes—I'll take one of those with me!"

C-H Seventy Fifty SWITCH





A Feed-Through Switch That Sells on Sight

because it just naturally belongs with almost any portable electrical appliance. Just to mention that you can attach the Seventy-Fifty to the cord any place it's wanted—so it's right under the operator's thumb—means no reaching to overhead sockets, no walking across the room to push a button—how it saves current because it's so handy it can't be overlooked—and it at once appeals to you.

The C-H Seventy Fifty SWITCH

Can be used with any make of Electrical Appliance within its capacity of 750 watts—



—3 amperes, 250 volts; 6 amperes, 125 volts. Enclosing case is made of nicely-finished Thermoplax insulating material. The attractiveness and utility of the Seventy-Fifty means a steady demand.

Write Us Today for Full Particulars

The Benjamin Electric Mfg. Co., of Canada, Limited

11-17 Charlotte Street - Toronto, Ontario

Manufacturers of the *Benjamin "92" Two-Way Plug*

"FLEXTUBE"

FLEXTUBE

Specify FLEXTUBE on your orders to your jobber, and insist that FLEX-TUBE be shipped. It will save you labor costs, material costs and bother of all kinds.

Write for Bulletin No. 151 and sample.

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Manufacturers of

Electrical Conduits & Fittings

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Double Compounding  **Double Value**

F 10

Friction reduced to a minimum because the wire only touches the high spots on the "Roller Bearing Wireway" of

Northern Electric DURADUCT

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You'll know it by the black dotted line.

All reliable dealers sell it.

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IS THE MARK OF
DURADUCT

LINCOLN MOTORS

Simplicity
Lincoln Arc Welder

The Lincoln Arc Welder is a simple machine which any one can understand and operate.

The motor is a standard Lincoln Machine, designed to operate on the kind of electric current you use.

It is direct connected to a generator which delivers electric current at the proper voltage for welding.

The control panel mounts the two necessary meters, a small hand wheel for regulating current and the simple knife switch connections.

The stabilizer is an electric magnet which gives stability to the current and makes the arc easier to control.

Insist on simplicity when you buy a welder.

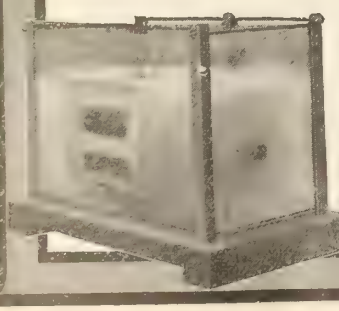
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"Link up with Lincoln"

Lincoln Electric Co.
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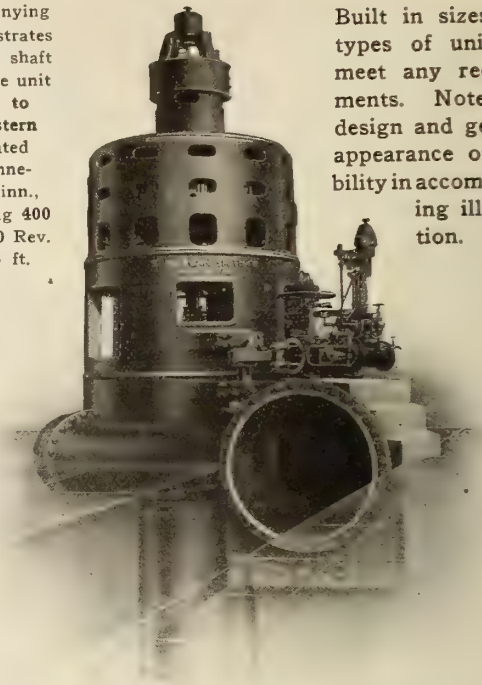
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SMITH HYDRAULIC TURBINES

Accompanying cut illustrates vertical shaft scroll case unit furnished to Northwestern Consolidated Mill, Minneapolis, Minn., developing 400 H.P., 450 Rev. under 45 ft. head.



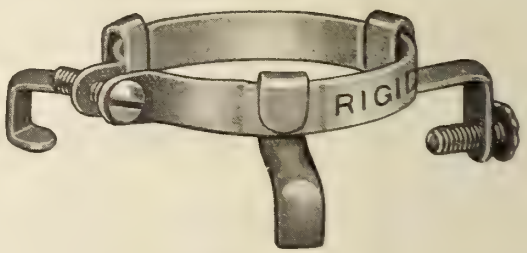
Built in sizes and types of units to meet any requirements. Note the design and general appearance of stability in accompanying illustration.

If interested in Water Power Machinery write Department "N" for Bulletin

S. Morgan Smith Co., York, Pa.

H. B. Van Every, Canadian Representative, 405 Power Bldg., Montreal

New "Rigid" Shadeholder



No. 400

Only One Screw to Adjust

Made for Brass and Porcelain Sockets
In 2¼ inch only.

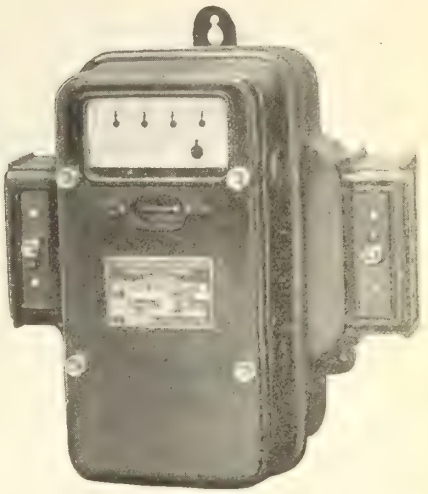
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Standard package 1000.

Manufactured by

The Duncan Electrical Co., Limited
1665 St. James St. - MONTREAL, QUE.

New Type Polyphase Meters

Specially Constructed



To start with one clearly-defined purpose—to pursue that purpose with a strong determination to excel, backed by experience, has been the effort of the Chamberlain & Hookham Meter Company.

Now, however, their ultimate success has been proved in this new type of Poly-Phase Meter. The basic principle of this exceptional quality may be attributed to the fact that they are constructed with a double terminal block, which ensures greater protection in overloads. Also, the insides of these meters are designed with plenty of room for connections—a safety feature in lightning storms and surge conditions. Moreover, all three wires are carried direct through the meter, from left to right.

These Poly-Phase Meters are used on the lines of the Hydro-Electric Power Commission of Ontario. Does not this prove recognized ability?

WRITE FOR PRICES.

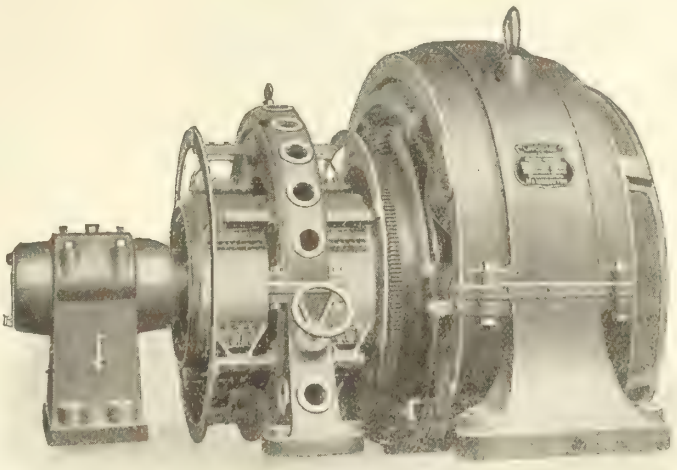
Chamberlain & Hookham Meter Co., Limited

243 College Street, TORONTO **61 Albert Street, WINNIPEG**

We have a large stock of motors up to 100 H.P. in Toronto ready for immediate delivery

The "Lancashire" Ball Bearing Induction Motor and "Patent Reversing Drive for Metal Planers," will repay investigation.

Descriptive matter sent on request.



100 H.P. Variable Speed Motor for Direct Coupling to Tyre Rolling Mill.

Accidents will happen, but a complete stock of spare parts and well equipped repair shop ensure users of "Lancashire" machines, minimum inconvenience from such breakdowns.

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Useful in the Shop and Laboratory for the Measurement of Resistance. Adapted for Fault Locations in Telegraph and Telephone Lines and Cables.

The Type S Bridge is a thoroughly practical instrument for shop and field use. Being complete in every detail it is ready at all times for immediate use. It is easily portable, its weight being but 8 pounds. The precision of adjustment of its coils (Rheostat 1/10 per cent., Ratio 1/20 per cent.) insures accurate measurements. The galvanometer, the weakest element of such an instrument, is unusually rugged. It is a separate element and may be removed for examination or repair by taking out two screws. The battery is of the ordinary "flash light" type, and renewals may be procured practically everywhere. The price is $66.25 net, f.o.b. Philadelphia, boxed for shipment.

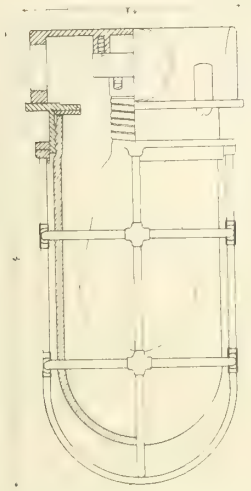
Bulletin No. 530 describes this instrument.

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Electrical Measuring Instruments

4912 Stenton Ave. **PHILADELPHIA, PA.**

BULK HEAD FIXTURE



The above cut shows one of the many styles of Marine Fixtures we are prepared to furnish.

STEEL CITY ELECTRIC CO., Pittsburgh, Pa.

APPROVED SERVICE FITTING



Cat. No. FB712

Replaces Types B, BE, F, and FE.

TYPE "FB" ENTRANCE FITTINGS

These fittings have reversible hubs, permitting installation either as type "F" fittings on vertical pipe, or type "B" fittings on horizontal pipe.

The same parts are used for ½ in., ¾ in., and 1 in. fittings, excepting hubs, there being a separate hub for each size. The covers and porcelain are interchangeable from one size fitting to another, giving a very flexible stock arrangement.

Metal parts black japan or galvanized finish. Black japan furnished unless otherwise specified.

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Ruby Ball Globes—Plain or Lettered

"Moonstone" and "Lumo" Globes *Give Satisfaction*



OUR street lighting globes, made from quality glass, used all over the Dominion. We make a specialty of lettering round and flat ball globes.

Get particulars and prices from our catalogues.

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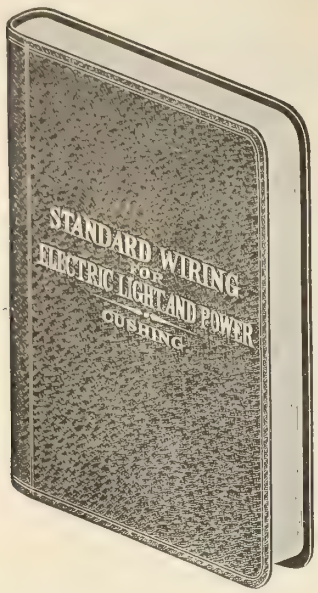
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THE NATIONAL AUTHORITY FOR TWENTY-FOUR YEARS

THE 1918 EDITION



POCKET SIZE
LEATHER COVER

"STANDARD WIRING"

TELLS YOU HOW

GENERATORS—How to install them, care for them and operate them; all their troubles and how to prevent and cure them; all diagrams showing connections for compound, series and shunt wound machines. How to operate them in parallel or in series. How to protect them and wire them in accordance with the underwriters' requirements.

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OUTSIDE WIRING—Pole line construction, line wires, service wires, roof structures, poles and their dimensions and weights, and how to erect and protect them and wires they carry. Insulators, guard arms, guy anchors. Tree wiring, splicing, service and entrance wiring. How to install Lightning arresters. Transformers with diagrams and instructions.

INSIDE WIRING—When and where to use rubber covered, slow burning and weatherproof wire. How to find the proper size of wire to use for lamps, motors or heating devices for any current, voltage and drop, either by formula or by the many tables that are given in this section of the book. How to wire for two-wire or three-wire systems. Direct current, two-phase and three-phase with formulae and tables, with examples worked out for each system and in a simple manner that anyone can understand and use. How to run wires on walls, ceilings, floors, through partitions and walls and in concealed places, damp places and where dangerous surroundings exist. When and where to install Switches, Cut-outs and Circuit Breakers and just how to do it. How to wire for high and low voltage systems and the precautions to be taken. The proper way to install Knife and Snap Switches, Cabinets and Cut-out Boxes. Outlet, Junction and Switch Boxes, Panel Boards, Wooden and Metal Raceways. How to install complete interior conduit jobs either for rigid metal, flexible metal or flexible non-metallic conduit. Concealed knob and tube work or armored cable. How and where to install and wire electric and combination lighting fixtures. How and where to use flexible cord and where not to use it. How to install arc lamps and gas filled lamps and the fixtures and rules required.

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All the necessary dimensions, capacities, weights, and other data on conduits, fuses, insulators, lamps, sockets, motor efficiencies, current per horse power of motors. Electrical units and their equivalents. Proper size of wire for all classes of power, light and heating installations. The proper symbols to use to indicate on plans just what is wanted from a motor to a small snap switch with all necessary diagrams.

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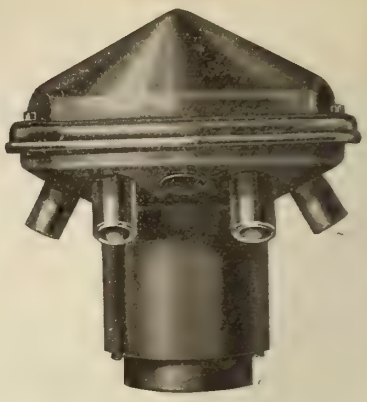
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"IT SETTLES DISPUTES AND, IF REFERRED TO BEFORE WIRING, PREVENTS DISPUTES"

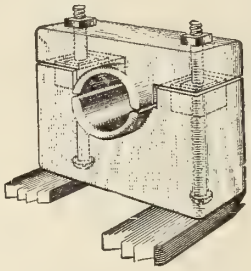

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That Stands the Test of Time and Weather
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"FRANKLIN" Cable Potheads
For all conditions. Require no wiped joint.
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ELECTRICAL DEVELOPMENT AND MACHINE CO., PHILADELPHIA, Pa.

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The Philadelphia Electric Company Supply Department
132 S. Eleventh Street - Philadelphia



TRANSFORMERS

Manufactured for all electrical purposes in any size, freqaency or voltage.

Lighting and Power Transformers
High Transmission Transformers
Single and 3-Phase Transformers

To secure prices give us K. W. capacity, voltage, cycles, transformers required.

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by the

"SPRACO" Method



Exterior view of cooling pond—United Last Co., Montreal

For the rapid and inexpensive cooling of water for condensors, water jackets, transformers and steam turbines, the Spray method is the most satisfactory. It is the scientific application of the simple idea of spraying water into the open air—this cools it and the water s collected in the cool pond and used over again.

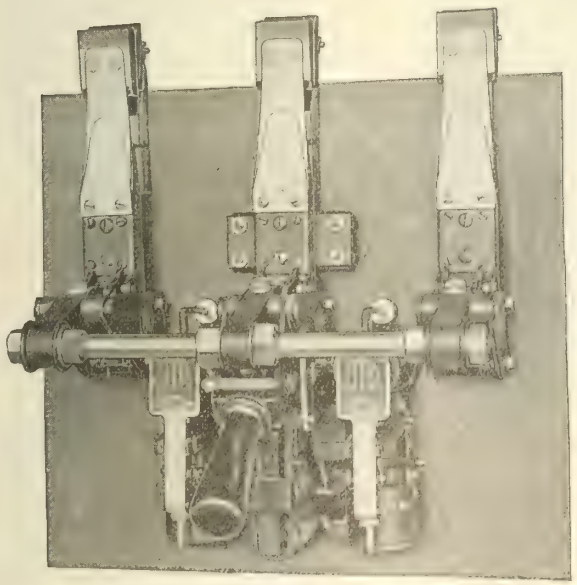
"Spraco" equipment also includes air washers for supplying cool, clean air for high capacity generators.

Our engineering staff is at your service. Literature sent on request.

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I-T-E CIRCUIT BREAKERS



TYPE W

Non closable on overload. Direct acting, time limit and "No Voltage."

For motor protection, especially A.C., 440 volts or less, the

I-T-E CIRCUIT BREAKER

has advantages not possessed by any other piece of apparatus. This is why one concern recently ordered over two hundred of them.

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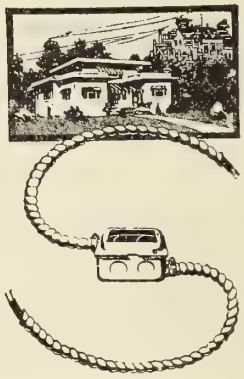
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BX ARMORED CABLE

BXL
Used in damp places.

BM
For marine work.

Flexible
Armored Cord.



Flexible and Rigid
Conduits

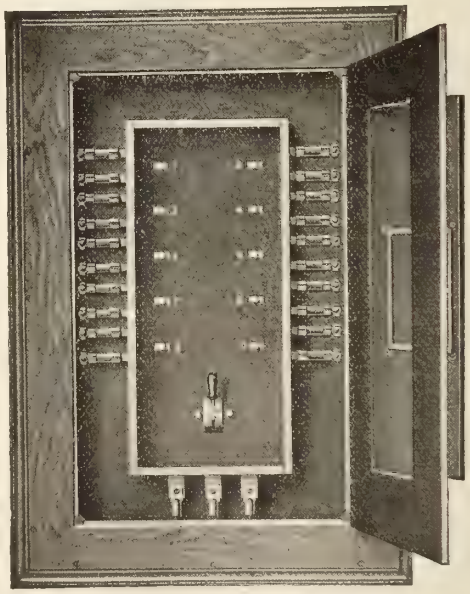
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Covers.

Fittings and Tools.

Sprague
Safety Type
Lighting Panels.

The
Brush Contact
MAIN SWITCH
is an important
feature.

All parts are
removable from the
front of the board.



Panel for N.E.C. Fuses

All
Current Carrying
Parts
Protected

Branch-Circuit
Switches
are of 30 amps.
250 volts
capacity.

Panels
are also made
for
Edison Plug Fuses.

Write to Our Nearest Office for Particulars

CANADIAN GENERAL ELECTRIC CO.

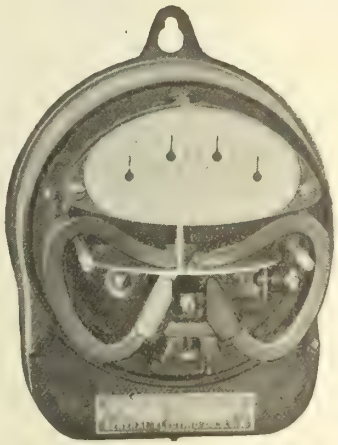
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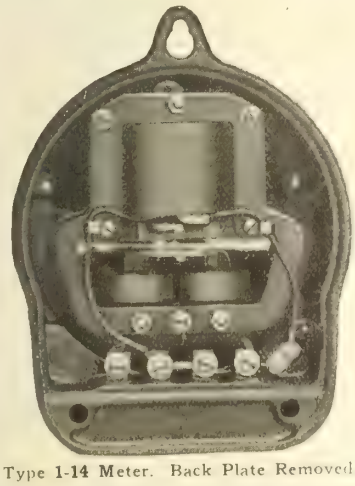
Bearing Construction

An Important Feature of C-G-E Meters

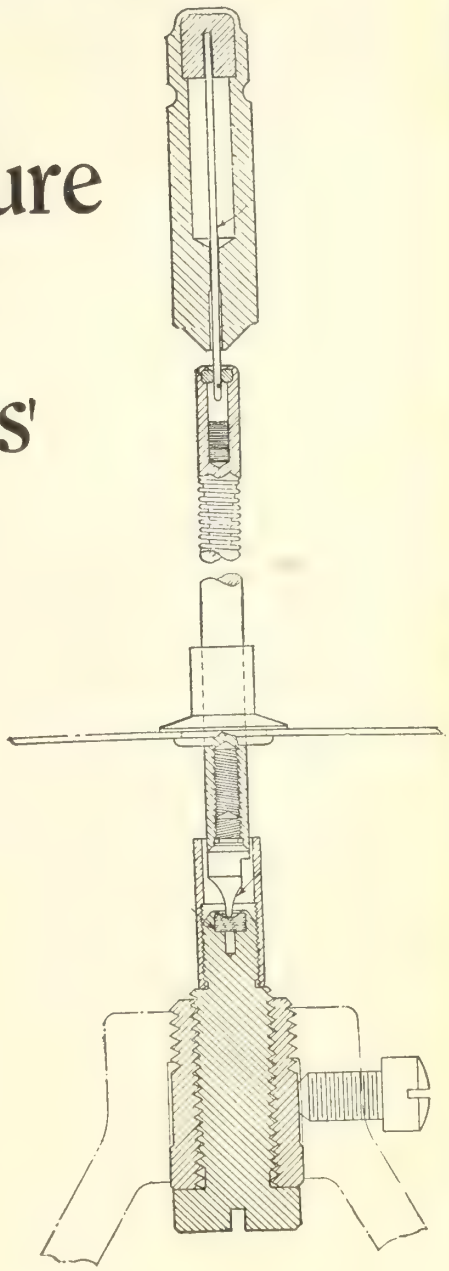




Type 1-14 Meter. Cover Removed.



Type 1-14 Meter. Back Plate Removed



The jewel is a high grade sapphire, carefully selected and mounted. The pivot is hardened steel, carefully ground and polished. The top bearing is a guide bearing only, and carries no weight.

All jewels are subjected to high power microscopic inspection in order to insure a perfect finish.

The BEARING CONSTRUCTION, ACCURACY and ACCESSIBILITY of C-G-E alternating current watthour meters are forceful arguments for their universal use as your watthour meters.

CANADIAN GENERAL ELECTRIC CO., LIMITED

Head Office [illegible] Sales Offices: Montreal, Halifax, Sydney, Ottawa, Cobalt, South Porcupine, Toronto, Winnipeg, Calgary, Edmonton, Nelson and Vancouver

Packard

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JNO. E. RUSSELL, VICE-PRESIDENT
W. W. BARRETT, SECRETARY-TREASURER

STEEL CASTINGS ELECTRIC FURNACE PROCESS

ALLOY STEEL WORKS, LIMITED

400 FRONT STREET EAST
TELEPHONE MAIN 6458

TORONTO, December 20th, 1917.

Packard Electric Company, Limited,
St. Catharines, Ontario.

Gentlemen;-

We desire to express our appreciation of the manner in which you handled our order for the three 100 K.V.A. transformers. This order was placed on December 3rd, and to have the transformers shipped on December 19th, taking into consideration that all the drawings and material had to be arranged for after the order was placed, is in our estimation, simply marvelous, and we can not thank you too much for the way in which our order was handled by you.

Again thanking you for your promptness in delivering these transformers and wishing you the Compliments of the Season, we beg to remain,

Yours very truly,
ALLOY STEEL WORKS, LIMITED
PER H. I. Armstrong
Managing-Director.

HIA/m.

ALL AGREEMENTS CONTINGENT UPON STRIKES, ACCIDENTS OR OTHER CAUSES OF DELAY BEYOND OUR CONTROL
ALL PATTERNS HELD AT OWNER'S RISK

The letter reproduced is not an exceptional case. It is an evidence of our regular service that you get when you order Transformers from this house.

Packard Transformers are built for Large Power, also Special Furnace Transformers and Current and Potential Transformers. Welded Steel Cases.

Information, latest bulletins, estimates, etc., sent on request.

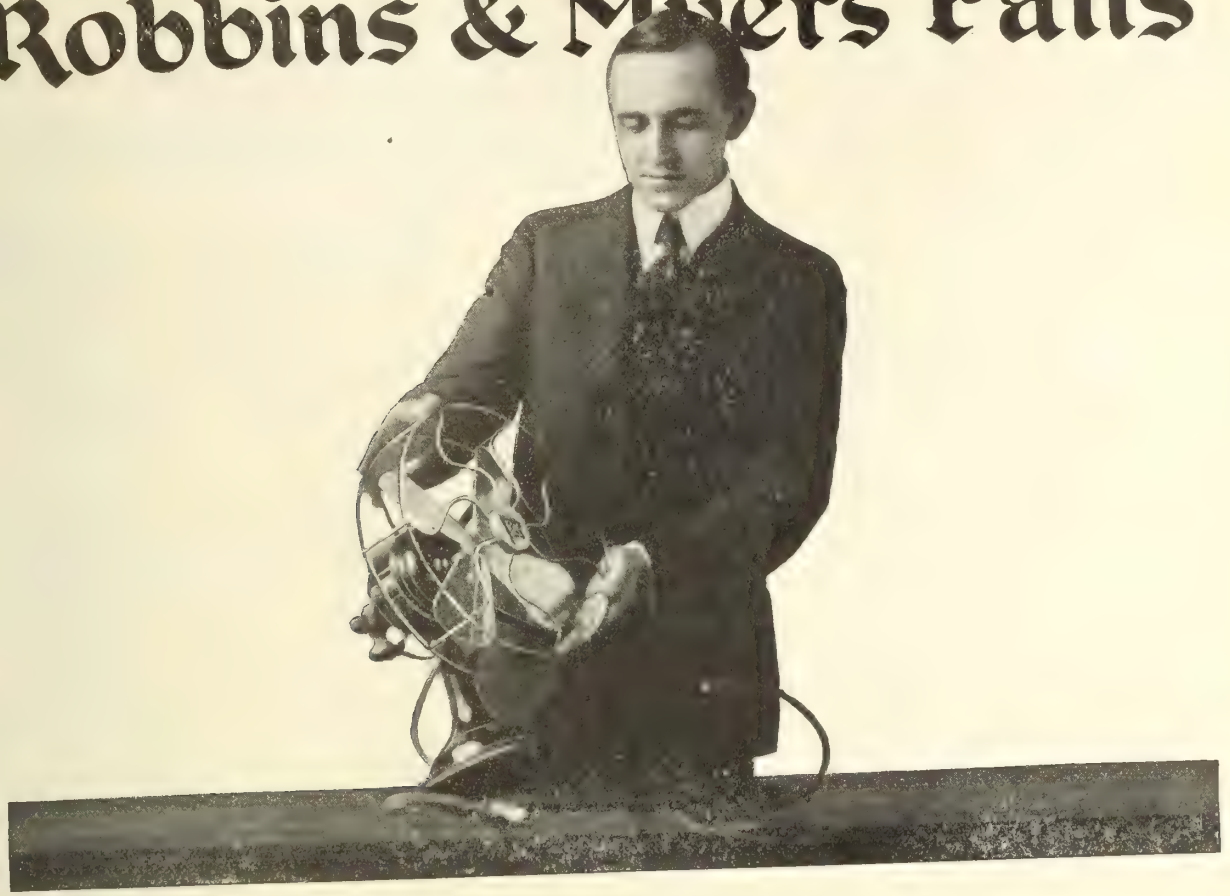
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ST. CATHARINES, ONT.

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Donalda Block, Winnipeg

Robbins & Myers Fans



THE beautiful finish and graceful design of The Robbins & Myers Fan are a big sales help for the dealer. They attract the customer's attention immediately and carry a strong suggestion of the quality built into the Fan.

The graceful outlines, the smooth, even surface of the drawn steel frame and base, the highly polished brass blades, the neatly constructed guard, the felt base, the smooth, gloss-black, baked enamel finish and the neat gilt stripes are all features of the R & M Fan which make a strong appeal to the buyer and result in easy sales for the dealer. Quality is reflected in the appearance of every detail.

And in every respect—performance, durability and efficiency—the R & M Fan measures up to its appearance. When you sell a Robbins & Myers Fan you know your customer will be just as highly pleased with the service it will give as he is with the appearance. He is insured many years, probably a lifetime of reliable fan service.

Appearance, performance and reputation all contribute to easy, profitable sales when you sell Robbins & Myers Fans.

R. G. Cowley

Manager, Chicago Branch.

The Robbins & Myers Company

Springfield, Ohio

New York Philadelphia Boston Cincinnati Cleveland Chicago Buffalo St. Louis San Francisco

CANADIAN DISTRIBUTORS

The Century Electric Co. Montreal
Costello & Crowe. Ottawa
Dawson & Co., Ltd. Montreal
La Cie Codere & Fils, Inc. Sherbrooke
Mechanics Supply Co., Ltd. Quebec
Eastern Electric Co. St. John
John Starr & Sons Co., Ltd. Halifax
Great West Electric Co. Winnipeg
Rogers Electric Co., Ltd. Toronto



Fig. 1

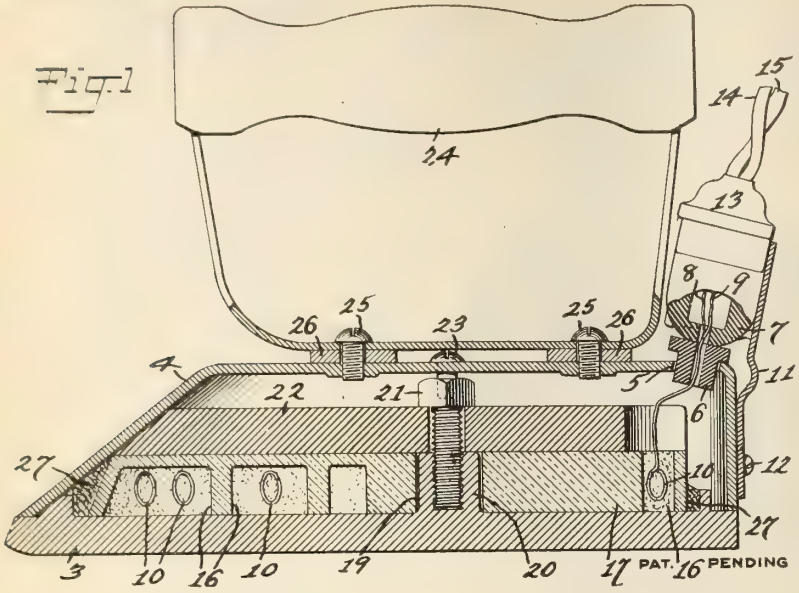


Fig. 2.

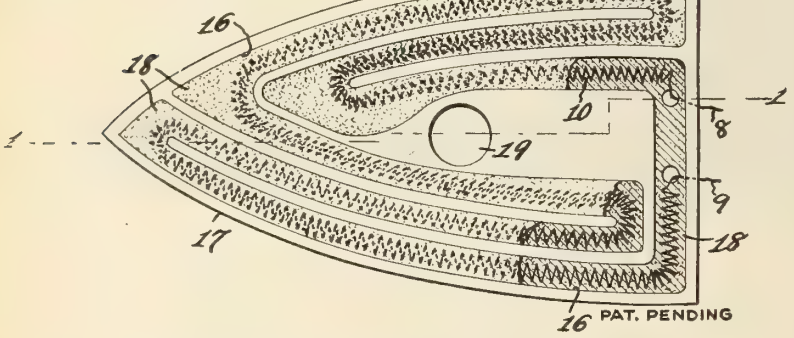


Fig. 1 is a section of the iron, showing clearly the method of assembly. The metal case (3) is highly polished and plated on under surface, having a rabbet at the upper outer edge for the reception of the cover (4), having a central opening (5) in the rear end for the porcelain bushing (6) connecting with plug base (7) containing terminal binding screws and posts for the ends (8) and (9) of the resistance wire (10), and which ends pass upward through bushing (6). The plug base (7) is held to the cover (4) by means of a plate (11) detachably secured to this cover by screws (12), and the plug base (7) is adapted to receive the plug (13) of the lead wires (14) and (15), which are attached to lamp socket, or other electric fixture. The resistance wire (10), coiled, is laid in channel (16) of porcelain plate (17) and channel (16) is filled with cement (18), which protects and preserves the element (10). This cement can be easily dug out in case access is desired to the wire (10). The porcelain plate (17) is provided with a hole (19) for the passage of a boss (20) cast integral with base (3) and the height of which exceeds the vertical thickness of the porcelain insulator (17). Held on top of boss (20) by a screw (21), is weight plate (22) and the cover (4) is held in place by means of a screw (23) threaded into cap screw (21). Note that this method of assembling is very simple and substantial. By having the boss (20) extend above porcelain plate (17), the weight plate (22) does not touch or bind on the porcelain insulator (17), we thereby eliminate the possibility of breaking the insulator (17) by the expansion of metal bodies (22) and (3), when heated.

The Seventh Anniversary of the Canadian Queen Electric Iron and Toaster

Seven years ago this month the first Canadian Queen Electric Iron and Toaster was built and they are still in use. Some dealers remark "they last too long, a customer will never need a new one."

The Canadian Queen line is designed with that result in view, as you will note by the cut and description.

We now have our new factory finished, which enables us to double our production so that prompt shipment is guaranteed.

In the "New Canadian Queen" electric iron the heating element wire is placed in a heat resisting porcelain plate, as shown in Fig. 2. The channel is then filled in with a special cement, composed of materials that tend to preserve the element from oxidation; this being accomplished, the element should last indefinitely.



If your jobber cannot supply you, let us hear from you direct. Ask for folder "K."

THE FLEXIBLE CONDUIT CO., LIMITED

GUELPH - - CANADA

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Generation, Transmission and Application of Electricity

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Orders for advertising should reach the office of publication not later than the 5th and 20th of the month. Changes in advertisements will be made whenever desired, without cost to the advertiser.

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Cold Weather Makes Converts to Electric Heating

The recent record cold snap, coupled with the shortage of coal, has made many converts to the use of electricity for auxiliary heating. This is satisfactory not only in its effect on popularizing electric heaters, but also in that it has operated for real economy and a conservation of fuel.

In this latter connection there is more to the argument than may appear on the surface. The use of electric heaters in the house, for instance, means something more than a mere auxiliary heat to be called into requisition when the coal furnace is unable or unwilling to respond to the demands of several degrees below zero. Like all other machinery, the coal furnace has its maximum point of efficiency, which point is passed when an overload demand is made upon it. It follows then that any overload makes an abnormal demand on the coal bin and that the extra heat so developed becomes more and more costly as the overload is increased. Just here then is where the electric heater comes in. Let us say, by way of example, that the furnace in a certain home, working at maximum efficiency, keeps the temperature at 70 degrees when the outside temperature is zero. If now the outside temperature falls, say, to 10 below, the furnace still working at maximum efficiency only maintains a temperature of 65 degrees within the home. To obtain the extra 5 degrees puts a strain on the furnace, or requires more frequent feeding and attention to such a degree that the cost of the little extra heat required may be two or three times normal, or even more than this.

Then, too, we have the case, quite common, we believe, where one part of the home is required at a higher temperature than the rest. This is especially true of the quiet evening hours devoted to reading or conversation. In such a case the electric as an auxiliary has proven itself ideal, in that it is quick to respond to the demands made upon it and that it delivers heat at the point where it is required—and that point only.

Of course, there is a shortage of electric power at the present time which must have a considerable bearing on the whole question, but when it can be shown that electric heating, used as indicated above, is actually in the interests of conservation, this, along with the additional arguments in favor of electric heaters, should free us from any accusations of advocating a luxury. In the truest sense of the word electric heating, intelligently used as an auxiliary, is conservation of power.

The Acute Coal Situation and Its Moral

The acute situation regarding the coal supply at various points throughout Canada during the past few weeks adds timeliness to a strong article by Mr. Arthur V. White, consulting engineer to the Commission of Conservation, which appears in the annual number of the Monetary Times, under the heading, "Coal Problem of Canada Demands National Action." Mr. White points out that the supply of coal is far from being inexhaustible in the United States and that we may naturally expect to be obliged in the near future to depend on our own resources. In other words, the temporary crisis of the past month will become a permanent condition, the solution of which must rest with ourselves. In that sense our troubles might prove to have been a blessing in disguise if they succeed in impressing upon us the necessity of getting ready for that inevitable event of which we can now, from our recent experience, form some reasonable estimate.

As a substitute for United States coal, which, in all human probability, we shall lose, Canada has two considerable resources, soft coal and water power. Canada may indeed claim to be well supplied with coal, but unfortunately it is of a quality not suitable, in its natural state, for shipment across the continent. One of the big problems before us, then, is to discover some means of economically utilizing this vast resource, it may be by transforming our coal into more stable form so that it will stand shipment, or it may be by converting it at the mines into electric energy and transmitting the power in this form. The latter alternative, however, awaits developments in the electric industry that we may not see in the near future. The former is said to be an accomplished fact but very expensive in operation.

The other substitute—water power—Canada also possesses in considerable degree; Mr. White says roughly twenty million horse-power. Much of this, however, is located so far from our more thickly populated areas that it is, temporarily at least, without value to us. This is all the more reason why we should guard with the greatest care the small fraction of the total found within our useful areas. The better located a water power is, the more reason why its control should be guarded, and also the more vigilance required in properly guarding it, as, naturally, control of such power would be more eagerly sought in proportion as its availability increases.

One does not realize the vast heritage with which the people of eastern Ontario, for example, have been endowed, by simply gazing on the St. Lawrence River. Figures change the viewpoint, however. Let us suppose that the Long Sault is capable of developing 500,000 horse-power continuously. Roughly speaking, it requires ten tons of

coal to provide one horse-power year. **Thus the power of the Long Sault rapids is the equivalent to the province of Ontario of 5,000,000 tons of coal per annum for all time.** The total import of anthracite in 1916 was 4,570,815. Therefore, a proper guarding of our Long Sault heritage alone will take care of the situation when the United States finds it necessary to withhold her anthracite for her own people's use.

How soon that may be is problematical. Our neighbors to the south have been tremendously "white" during the crisis just passed, but let us not forget that their resources are limited, and that charity begins at home. The necessity to withhold export to Canada may arise sooner than they, or we, expect.

For a permanent crisis, such as we have just had a taste of, and which may come to-morrow, shall the people of Canada not do well to hold themselves in readiness, so far as is humanly possible, by conserving for our own people the heritage Providence has willed us?

Abandonment of Aqueduct Scheme Approved by Research Bureau

The abandonment of the plans for enlarging the Montreal aqueduct and for the construction of a plant to develop hydro-electric power, aside from construction required to permit its use as a source of water supply, is recommended in a report by the New York Bureau of Municipal Research, which is investigating Montreal's civic problems. The bureau also recommend that prompt consideration be given to providing funds for the design and construction of an electric power plant to furnish the service required for pumping or other municipal purposes, and that the present steam plant be kept in reserve for stand-by service.

The bureau finds that there has been lack of adequate study and consideration of the project as a whole before authorizing the execution of the works; illogical and conflicting statements in the various reports issued on the subject, and lack of consideration of possible alternatives for securing an economical water supply.

"There is probably no large city on this continent which is so strategically located in respect to the availability of cheap commercial electric power as Montreal. In spite of these facts, the city government has undertaken the independent development of hydro-electric power, practically in direct competition with the private companies at present serving the community in this respect or those able to furnish electric power. The proposed development, if completed, will provide, during certain seasons at least, an excess of power over that required for pumping and other water supply purposes, and yet no well-matured plan has been formulated for the economic utilization of the excess. Even in the matter of municipal needs for electric power, such as, for example, to provide for the lighting of streets and public buildings, there is no evidence of any adequate consideration having been given to the practicability of making use of available power from a city plant for such purpose. It would, then, appear that the city has no reliable data on which to base a justification for undertaking the project at all."

The report criticizes the plans of the city's staff and of Messrs. Vautelet and St. Laurent, and suggests, as an alternative, the abandonment of the proposed power development, the purchase of electric power, the construction of an electric pumping plant for 100,000,000 imperial gallons per day, at a cost of $361,000, the use of the present steam plant as a stand-by, and the use of the aqueduct for water purposes only. The report insists that the purchase of power would prove much more economical as compared with the present hydro-electrical development.

The bureau discusses at great length additional sources of water supply, and comes to the conclusion that the most practical scheme is the utilization of the aqueduct as a source of water supply. This involves the abandonment of the aqueduct enlargement project, including the development of a hydro-electric plant. The construction required to enable using the aqueduct would be limited to the building of an impounding dam at its lower end, with suitable provision for sluice-gates and spillway, together with some possible trimming up of the unfinished sections of the enlargement work.

Flattening Down the Peak

In our last issue we described briefly how the peak load situation was being met in Brantford, Ont., through the co-operation of the various industries throughout the municipality. A recent issue of the Electrical World describes similar operations by the Traction, Light and Power Company in Puget Sound, where Sales Manager Gille has made a successful study of how to relieve power conditions. The salesmen interviewed all power customers over 50 h.p. in an endeavor to secure their co-operation in smoothing out the load curve during the critical weeks preceding and immediately following the new year. In this city the hours of 4.30 to 7 p.m. mark the limits of the critical period. The peak is caused by the overlapping of the lighting and industrial power loads with the electric railway evening rush hour demand. The reason assigned for this overlapping just at this time is that, owing to the number of cloudy and dark days and the consequent shortening of the daylight period, the commercial and residential lighting consumers turn on their lights before the one-shift power load goes off. Power consumers also use lights in their plants which at other times of the year they would not need. The street railway peak is around 5.30 throughout the whole year, and the company is, of course, powerless to shift it.

Calls for co-operation on the part of the power users met with prompt response. Out of 266 customers visited all but two were able to shift their load a little bit. By arranging an earlier closing hour with some 24 customers, 2,600 kw. was taken off the peak. By consulting with other large concerns having numerous employees, plans were worked out whereby these employees should be dismissed at half-hour intervals. This scheme not only relieved street car congestion, but assisted in smoothing out both the street railway and industrial load curve.

Having thus eliminated the more readily recognized overlapping, a systematic study was begun to find just what changes would be most advantageous. Each power consumer's load, with its characteristics, was plotted and listed on a large sheet to facilitate careful comparison. Preliminary examination of this collection of data indicates that it may be more desirable to allow certain power users having unrestricted service contracts to operate on the peak than to ask them to shut down just before that time, because the large number of factory employees who use the street cars may make an increase in the street railway load greater than the factory load cut off.

The Power Controller's Order

Sir Henry Drayton, Power Controller for Canada, has issued an order regarding power conservation in the province of Ontario, which comes into effect Tuesday, January 15. In effect it prohibits display advertising of all kinds; requires the discontinuance of ornamental lighting and the use of only such lamps in ordinary street lighting as are absolutely necessary. The public is also urged to save every little bit of current possible in the office, the home and elsewhere.

The order regarding the discontinuance of ornamental

lighting is probably not intended to be interpreted literally as this would leave the main streets of most of our cities and towns in absolute darkness. Presumably the intention is that only such of the ornamental clusters shall be lighted, or such part of each cluster, as is necessary for a fair illumination.

While this order will work some inconvenience to our citizens in general there is no doubt that they are ready to make whatever little sacrifices may be necessary. As the days lengthen, the inconvenience will diminish. The order is as follows:

"To all Commissions, companies or persons generating, distributing or using electrical energy in Ontario, where there is a shortage of electrical energy, or where electrical energy is being generated or supplemented by steam, gas or oil plants:

"It is hereby ordered and directed that the strictest economy in the use of electrical energy be practised. With this in view the Commissions and companies supplying electrical energy, and the officers of corporations, as well as individuals using electrical energy, will on and after Tuesday, January 15, 1918, and until further notice, see that no electrical energy be used for advertising or ornamental lighting; that electric street lighting be reduced to the utmost possible limit—discontinuing cluster lighting entirely and only using such lamps as are actually necessary for the safety of the public.

"Under the heading of advertising is included the interiors of buildings during hours when the latter are not open for business.

"Turn off every lamp and switch off every heater or motor, the use of which is not absolutely needed.

"Electrical energy is vitally needed for the manufacture of many war essentials, and these can only be manufactured if every user of electrical energy helps in reducing the present general consumption. Coal is being used to relieve the water-power shortage and the costliness and scarcity of coal are well known.

"(Signed) H. L. Drayton,
"Power Controller.

"January 8, 1918."

Ontario Hydro Establishing Testing Laboratories

At the call of the chairman of the Electrical Section of the Toronto Board of Trade, a well-attended meeting of representatives of electrical manufacturers, distributors, and contractors was held in the Board of Trade rooms, Royal Bank Building, on Monday, January 7, at 2 p.m., to discuss the recent announcement of the Ontario Hydro Commission, appearing on page 36 of the Electrical News, January 1 issue. Mr. H. F. Strickland chief of the Hydro inspection department, represented the commission.

Mr. Strickland at some length explained the intentions of the commission. It was proposed to establish a testing laboratory in Toronto, duplicating in its essential parts the laboratories of the Underwriters' Association in Chicago. This laboratory was not intended to supercede the Underwriters' Laboratories, but to supplement their work, its main function being to test and approve such appliances as may be manufactured within the Province of Ontario, or may be offered for sale in the province without having first been approved at Chicago. Mr. Strickland stated that it may be taken for granted that appliances having the approval of the Underwriters' Laboratories would automatically be accepted by the commission in future, just as in the past, and he hoped that reciprocal arrangements would be made in the near future whereby products passed by the Hydro Laboratory would be automatically approved by the Underwriters. At the present time a number of unapproved appliances were being sold in the province, manufactured no one knew where, the distribution of which it was impossible to control. After April 1 it would be a punishable offence to offer such for sale without first having them passed upon by the Hydro Laboratory.

The matter of changes in the rules and regulations of the Hydro Commission was also discussed at some length. A number of members complained that these changes, coming into effect at short notice, had worked hardship in certain cases on those firms carrying considerable stocks of equipment formerly approved, but not now accepted under the amendments. It was thought that the commission might, with profit to both sides, keep themselves more closely in touch with the conditions and sentiments of the trade in general. To this end it was suggested that it would be a move in the right direction if the commission could see its way to include in their Rules and Regulations Committee some outside members of the electrical industry. This suggestion met with unanimous approval, and a resolution was finally adopted which is being forwarded to the commission, requesting that their Rules and Regulations Committee be enlarged to include not less than five members, representing the manufacturing, distributing, and contracting interests.

The selection of names to act on this committee was left over, pending the acceptance of this suggestion by the commission. The intention is that the choice shall be fully representative of the various electrical interests concerned.

Canada an Exporter of Electrical Energy*

Other than the products of her agricultural lands, mines and forests, there are certain resources in Canada of unique and special value. One of these is the hydro-electric energy which may be developed from Canada's waters, including her equity in international waters. At the present time the United States is importing from Canada about 275,000 horsepower years of electrical energy. Many factors, of course, enter into the determination of the equivalent of this electrical power in terms of anthracite coal. Electric power has great advantage for many purposes over steam. Speaking in round figures, and taking cognizance of some of these special factors, the electrical power now imported by the United States would be the equivalent of probably not less than 3,000,000 tons of coal, annually—it may be a quantity substantially greater.

Canada has been richly endowed with water-powers, although those serviceable from the standpoint of present economic development should be carefully conserved so that they may be used in the general public interest.

Any estimate for the water-powers of Canada must be presented and considered with a due appreciation of its limitations. The following table representatively sets forth the water-power situation in Canada. By no means may all the water powers be economically developed:—

Province	Total possible horse-power	Developed horse-power
Ontario	5,800,000	760,000
Quebec	6,000,000	640,000
Nova Scotia	100,000	26,000
New Brunswick	300,000	15,000
Prince Edward Island	3,000	500
Manitoba	.....	76,000
Saskatchewan	3,500,000	33,000
North West Territories		
British Columbia	3,000,000	250,000
Yukon	100,000	12,700
Total	18,803,000	1,813,200

Men far-sighted in the fields of industry and finance have foreseen the extent to which present and future gen-

*From article by Mr. A. V. White, in Monetary Times.

erations will be increasingly dependent upon power, whether it be steam or hydro-electric.

Concentration of Control

In the United States, for many years past, special efforts have been made to concentrate control of water-powers. Most of the water-powers which are more readily capable of economic development in Canada, as well as in the United States, either have been already developed or are privately controlled. Concentration of ownership is a noticeable feature of this control. It has been authoritatively published that in the United States, in 1913, about 6,300,000 horse-power was controlled by ten groups of interests. This concentration is still going on. Owing both to provincial and federal legislation, it has not been possible for interests so readily to obtain control of water-powers in Canada. Efforts, however, are continually being made to secure the rights for such desirable water-powers as are yet vested in the Crown. The efforts made by the powerful financial interests behind the Long Sault Development Company to obtain control of the almost unequalled power rights at the Long Sault Rapids, on the St. Lawrence River, are still in mind.

"Patents" at the A. I. E. E.

Those members of the Toronto Section A.I.E.E. who had the misfortune to be absent from the lecture by Major C. H. Riches on Friday evening, December 21, have much to regret. The subject of the History of Patents has, we are sure, never been presented in so entertaining a fashion; the trading monopolies granted to the Hanse towns in the middle ages, the privileges bestowed upon traders by English monarchs, and the famous act of James I., all were shown to have direct bearing upon the modern form of patent as granted by the Patent Bureaus of Canada, England and the United States. At the conclusion of the lecture a concise summary of the present aspect of patent law and procedure was given. Afterwards Major Riches answered a number of questions fired at him by those members whose inventive genius led them into doubts and difficulties concerning the procedure of securing a patent. The discussion indeed was quite extended, more than forty minutes being devoted to it The lecture was one of the best and most original ever presented before the section, and together with the pleasing personality of the author, yielded a most enjoyable evening.

The 1918 Program

A most attractive program for 1918 has been arranged by Mr. A. H. Hull, Chairman of the Papers Committee of the Toronto Section A.I.E.E. It has been found desirable to hold two meetings in every month (first and third Fridays) and the arrangements are:

Jan. 18.—Commercial Applications of Synchronous Motors, Morris J. McHenry, Canadian General Electric Company, Toronto.

Feb. 1.—The Laws of Dielectrics, Charles E. Skinner, Research Division, Westinghouse Electric Co., Pittsburgh.

Feb. 15.—Technical Education in an Engineering Works, Channing R. Dooley, Educational Department, Westinghouse Electric Company, Pittsburgh.

March 1.—Recent Developments in Transformer Practice, John J. Frank, G. E. Co., Transformer Engineering Dept., Pittsfield, Mass.

March 15.—High Voltage Testing (with experiments), William P. Dobson, Hydro Electric Power Commission Laboratories.

April 5.—High Tension Insulators from the Operating Viewpoint, Paul Ackerman, Toronto Power Company.

April 19.—Annual Meeting, Dinner and election of officers.

The Time to Sell Appliances

Aside from the question of power shortage there probably never was a more opportune time to push the sale of electric appliances than is the present moment. The average small consumer of electric current is making "good money" to-day, and, it goes without saying, is spending it. Supplied, as he is, with comparatively ample means, he is looking about for a little larger share of that comfort and luxury so often denied the man of slender income. What better can he invest his money in than attractive fixtures for his home and modern electric appliances of every sort. Unless, therefore, it is the case that any small increase as this would entail in the household power load will embarrass in any way those who are responsible for supplying the needs of our soldiers, the present conditions of labor, well supplied with ready money, seem to enforce almost a patriotic duty on our retailers of electrical goods to see that this surplus cash is exchanged for merchandise that will add not only to the comfort and pleasure of the working man and his family, but also in a very high degree to efficiency in his daily work.

Honor to Whom Honor is Due

Of the 650,000,000 tons of coal which will be mined this year only 4 per cent. represents the entire electric central station requirements of the country, the greater part of the electrical energy now used being generated in hydro-electric stations. By utilizing water-power the central station industry conserves nature's resources, releases millions of tons of coal, the cars necessary to transport it, and the labor required to mine it, while the coal it consumes, as the fuel administrator himself has graciously allowed, is burned most economically. In view of the wide publicity given to the sign-lighting orders, which indirectly involve the electric lighting industry, it is well that these facts be constantly borne in mind. Fuel-saving, however slight, is vitally necessary in the present world-crisis, but we suggest that as a matter of self-interest any striving for psychological effect be definitely labeled as such. From the usual tone of press reports the general public is led to believe that the central station industry is most profligate in the use of coal, whereas just the opposite is true. There is nothing in the entire engineering history of the industry which, even in the present emergency, warrants anything but praise.—Electrical World.

Canadian Light and Power Win in Review Court

The First Division of the Court of Review, Justices Fortin, Greenshields, and Lamothe, recently gave judgment to the effect that the Canadian Light and Power Company was not liable for the $126,221.35 claimed in connection with the contracts executed by G. W. T. Nicholson at the company's hydraulic plants at St. Timothee, in 1910 and 1911. Mr. Justice Maclennan, in the Superior Court on January 17, 1916, had condemned the company to pay this amount for damages claimed by the contractor, but the review judges held that the claim was not justified. The review judges were unanimous. The action against the company was for $225,692.82, which included the $126,221.35, and as a result of the Court of Review judgment the company will have to pay only $99,471.47 for works executed.

More aid to struggling electric railways in New York State has been granted by the Public Service Commission for the Second District. On December 13 and December 15 the commission announced increases in fares from 5 to 6 cents for the Glen Cove Railroad, and from 5 to 7 cents for the Peekskill Lighting and Railroad Company.

An Automatic Hydro-Electric Station

Four Units of 500 H. P. Each Operate Automatically and Entirely Without Human Supervision

At Cedar Rapids, Iowa, a 2,000 kw., low-head, hydro-electric station recently constructed is now being operated entirely automatically. The installation consists of four 500 kw. units.

The hydro-electric plant has been arranged to operate in parallel with a 19,000 kw. steam generating plant located about half a mile away. It was originally planned to operate the hydro-electric plant by remote control from the steam plant, but as this involved a large number of complications, it was finally decided to install a completely automatic control. In this way a saving in the neighborhood of $4,000 a year in labor has resulted and it has worked out that the first cost is no greater than would have been required for a first class manually operated station. The general operating features are described in a recent issue of the Electrical Railway Journal.

General Operating Features

As the station equipment is arranged and will usually be operated, the control of the machines will be handled remotely from the steam station, where the simple act of removing one small double-throw switch on a bench board will start the automatic control equipment at the hydro plant in its series of functions in placing a machine on the line, without further attention from anyone. These same switches on the benchboard, however, set in the opposite position, leave the number of machines running in absolute control of the automatic equipment at the hydro plant which is actuated by the level of the water in the storage reservoir. The conditions of load will not at any time determine the number of machines cut on or off the line. It will simply be the practice to load the hydraulic plant up to the capacity which the water flow will allow, or which emergency requires, and the load fluctuation on the system will be taken care of at the steam station. If left to the purely automatic control, a lowering of the head beyond a certain level automatically cuts the generators off the line in a certain sequence. Conversely, with a rising head the machines will start up and come in on the line as rapidly as the rise in water level permits. Any trouble whatever instantly cuts the machine or machines out and thus gives protection, regardless of the position of switches at the steam station, and then automatically brings them back on the line when conditions have become normal again. In brief, the complete control scheme includes a purely automatic control on which is superimposed a remote manual control. The former operates in accord with the water supply, while the latter causes machines to be cut in or out at the will of the steam plant operator, by means of the automatic equipment, regardless of water conditions.

As many machines will be run during the day through the remote control supervision as is possible and still permit the river to store up water for full-load operation of the plant during the night. This plan of utilizing the full flow of the river has been adopted as the one which best fits in with the load conditions on the systems. The operation of all three units at the hydro-electric station permits the shutting down of one boiler at the power house during the night.

Special Features of the Layout

The interest in the plant lies principally in the selection and arrangement of the electric automatic control apparatus. The control equipment for the most part, consists of apparatus of standard design for steel-mill work. This type of equipment was selected because of its sturdy and not over-sensitive characteristics. Hence, while the application of the automatic apparatus to the hydro-electric generating equipment is entirely new, the control equipment itself is of usual design, but assembled to perform special duties. This equipment is installed on three generator control cabinets and one exciter control cabinet located along one side of the power plant. There is also a terminal board cabinet which has been used as a terminus for all control and instrument wires. Beside each of the generator cabinets is the motor-driven rotary drum controller which determines the sequence of operation of the various relays and contactors in the same manner that this is accomplished in connection with the automatic railway sub-station. All instrument wires are brought to terminals in the instrument cabinet so that it is possible to cut in portable instruments for testing, in the absence of the permanent meters which are all installed in the steam plant. One feature of the control which differs from that which has been employed in the automatic sub-stations is the over-speed protection device. In the automatic sub-station this is a simple mechanical device placed on the end of each rotary converter shaft, which closes a circuit through a relay when the speed of the machine reaches a certain point, the relay acting to cut the machine off the line. In the hydro-electric plant this protection is provided for the entire station by a 1 horsepower induction motor which drives a speed-limiting device, closing a circuit through a relay in the same manner. As all generators are in synchronism, no one unit could race without carrying all others with it. This motor remains continuously on the line, since it consumes little power, and it was hardly worth while, therefore, to provide relays to cut it off.

Sequence of Operation

The sequence of operation of the control apparatus is in general as follows: When the operator at the steam station closes the small benchboard switch, previously mentioned, the drum controller at the hydro-electric plant starts to revolve. This same connection might have been accomplished by the action of the automatic float switches governed by the water level in the storage reservoir. The first circuit completed by the drum controller is through a relay which starts up one or the other of the exciter sets, depending on which way a triple-pole, double-throw switch is thrown. The 150-h.p. motor of this exciter set is thrown directly across a 2300-volt line, taking momentarily eight times full-load current and coming up to full speed and full voltage in three and a half seconds. Meantime the drum has continued to revolve and has closed the necessary circuit to energize the gate motor which opens the gate on the water wheel to about 0.2 full opening. After completing this contact the drum controller stops until the generator reaches a speed of 55 r.p.m., at which time a centrifugally operated switch on the top of the generator shaft makes a contact which starts the drum revolving again. This then completes the circuit which closes the main line contactor, putting the machine on the line without field and in series with a set of reactors which will limit the current through the unit to about 2.5 times full-load current during the synchronizing period. Two of these reactors, which are of the single-phase oil-immersed type, designed for five-minute duty, are

installed for each machine. A time interval between the closing of the centrifugally operated switch on the main generator and the closing of the main line contactor is provided in order to permit the generator speed to increase from 55 r.p.m. to 60 r.p.m., or synchronous speed, before the main-line contactor is closed. The next function performed by the drum is to close a circuit through the field coils. When the exciting current is first thrown on the generator field, it is limited by the field rheostat connected in the circuit to about one-quarter normal value. This gives the machine a chance to get in step, without unduly high current values. After a moment a section of the field rheostat is shunted out, increasing the field current to its normal value. The current-limiting reactors are then short-circuited and the contact-making ammeter closes a circuit through the gate motor which opens the gate to a point permitting the machine to carry full load. All of these operations require but thirty-seven seconds. The time which elapses from the instant the generator begins to take load until it is under full load is only seven seconds, because of the rapidity with which the gate-opening mechanism responds. In placing the generators on the line the action is similar to that of bringing a synchronous motor up to speed and placing it on full circuit. The ordinary synchronizing process as usually applied to generators does not become a part of the operation in this hydro-electric plant, since placing the machine on the line with low-field excitation allows the rotor to slip back or to be pulled ahead a fraction of a phase angle without trouble. Oscillograph records of the current in the main generator circuit show that maximum disturbance during the starting period is not serious.

Protection Against Possible Trouble

The bearings of each machine are protected against overheat by thermostats of the spiral spring type which are set to operate at 45 degs. C. Should a bearing become overheated, the thermostat would promptly act to cut the machine affected off the line. When the bearing cooled down to normal temperature the thermostat would automatically cut the machine in again. Thermostats are also placed on the current-limiting reactors and set to operate at 75 degs. C. Thermostats on the stator coils of the generators are set to operate at 65 degs. C. The speed-limiting device already described is set so that it shuts down the entire plant whenever the station frequency reaches 64 cycles per second. In a test of this device the main oil switch at the steam station was tripped from the benchboard, cutting all load off the hydro-electric plant, which, of course, would tend to make the machines run away. In one and two-fifths seconds after the oil switch was tripped the frequency limiting device operated and the water wheel gates began to close.

The possibility of a machine operating single-phase is prevented by the fact that part of the relays are installed in each phase, and the wiring is laid out so that the opening of any one of the relays will open all contacts and shut down solenoids, so that no-voltage failures are guarded against through the instant opening of all relays. The loss of excitation is guarded against by a relay in series with contacts which in opening shut down the plant. The generators are protected against surges by inverse time-element relays which cut the current-limiting reactors into circuit with the machine for an interval on not excessive overloads, before cutting the latter off the line. Under normal operation the 220-volt, 60-cycle energy supply for the control system is supplied from two 5-kv.a. transformers installed in the hydro-electric plant. In case of emergency, however, a throw-over switch supplies the control energy from the steam station power and lighting transformers.

The float switches guard against trouble from low water. No special provision has been made to guard against the accumulation of snow-ice, except the standard trash racks at the intake to the flume and at the intake to the wheel pits. In this connection it is interesting to note that a sudden stoppage of all units in the plant produces a piling of the water at the gate to such an extent that the back-wash effectively removes all trash from the rack and causes material which has gathered at the upstream trash rack to be washed over the spillways.

Group vs. Individual Motor Drive

There is always danger when reaction sets in against any certain established practice that the pendulum of modernism may swing a little too far the other way and deprive us of some of the advantages which a moderate viewpoint would have assured. This may be the case to-day with regard to the use of individual motor drives. The reaction which set in some time ago against group drive, based undoubtedly upon sound argument, has in some cases, we believe, led to installations of individual motors not justified by considerations of economy. "Just look at the current you save," is a forceful argument to the factory superintendent who is eagerly searching for every possible opportunity to cut costs, but too often this and similar savings take on an importance quite out of proportion to their real value. The superintendent would see the matter in a different light if he realized that the cost of current represented only in the neighborhood of one or two per cent. of the total operating cost rightly chargeable to that motor.

A very impartial article on the relative advantages of group and individual drive, written by C. E. Clewell, appears in a recent issue of the Electrical World. Extracts from this article are given herewith, as well as a couple of interesting drawings:—

As a basis for an analysis of these two methods of electric drive, it should be noted at the outset that the power consumption of a typical machine tool is usually a relatively small item in comparison with the other charges against the machine, Fig. 1. Any degree of saving in the power consumption will have a relatively small effect on the total cost of production by this tool, whereas any saving in wages brought about by the ability of the operator to perform a given operation in less time will obviously tend to a much greater effect on the cost of production.

The interest and depreciation on a machine tool together may form an item of importance. In this connection Fig. 2 indicates that the cost per horsepower increases rapidly for the smaller sizes of motors; hence the fixed charges on the smaller machine tools when equipped with individual motors are relatively higher than with larger tools where the rating of the motor is higher.

While the use of individual motors can hardly in any case be justified solely on a basis of power saving, any reduction in the power required to drive a given machine is a factor in the gross efficiency of the plant. Table I, therefore, is of considerable interest because it shows the friction losses connected with the line shafting in various typical shop departments. The losses given show the order of magnitude which may be reached, and hence give an indi-

cation of the economy which may be effected by the substitution of motor drive for any system of mechanical power distribution.

Conditions Favorable to Group Drive

In a general way the term "group drive," as here used, relates to those cases where one relatively large motor supplies a group of machine tools through line-shafting and countershafting, the sources of power being broken up into relatively small units. The excessive mechanical losses of the long main-line shafts usually employed with purely mechanical power distribution are thus reduced by the electrical distribution up to the group motors, but the mechanical losses usually present with line-shafting and belting still occur between the group motor and the machine tools to which it supplies power.

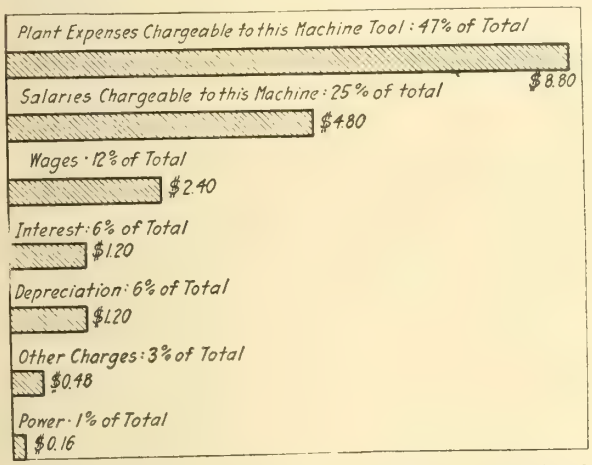


Fig 1.—Relative amounts chargeable to a given machine tool per eight-hour day for different items which make up total production cost.

Several fairly well-defined conditions occur under which group drive is usually preferable to individual-motor drive, and these may be listed as follows:

(a) Group of machines operated at constant speed, all machines being in operation simultaneously.

(b) Machinery close together and countershafts thus short; diversity factor that permits the installation of less gross horsepower with a single group-drive motor than when several individual motors are used. (This case applies with special force to the smaller motors of say 2 h.p. or less.)

(c) Constant-speed machines requiring excessive current at certain points in the duty cycle and when, owing to such conditions, the gross horsepower rating of individual motors would necessarily be higher than the horsepower rating of a single group motor.

(d) Where a group of relatively very small machines is found and where the investment in a motor for each machine be unduly high.

Under any of these conditions, however, the higher first cost of individual motors might easily be offset in a very short period if any considerable increase in production would result from their use in preference to a group motor. Furthermore, the first cost of individual-drive installations has often been increased in the past by the additional cost of mechanically attaching the motor to the machine. This objection is disappearing at the present time because of the growing tendency of the machine-tool manufacturers to design their machine tools so as to accommodate the motor.

The fact that at least 50 per cent. of the output of some of the larger machine-tool plants is now arranged for individual motor-driving is due partly, no doubt, to the increased demand of industrial plants for motor-driven machines, and also to some extent to the appreciation on the part of the machine-tool builders of the advantages of the motor-driven tool.

Advantages of Individual Drive

Turning now to some of these advantages of individual drive, it is important first to note how large a factor the reduced friction losses may be in the individual-motor problem. Figures gathered by A. G. Popcke for a typical case on which careful estimates were made for both methods of drive show that the increased first cost for individual motors may be offset in a relatively short time by the lower frictional losses brought about by their use.

In a case of group drive the total first cost per floor amounted to $8,700, proportioned as follows: For the main shaft, 27 per cent.; countershafts and pulleys, 57 per cent.; group motor, 5 per cent. The losses due to friction with the group system were estimated at $2,500 per annum.

Table I.—Frictional Losses in Shafting for Various Typical Shop Departments

Department	Per Cent. of Total Transmitted Power	Department	Per Cent. of Total Transmitted Power
Pattern making	17	Chucking	26
Grinding	21	Planing	26
Light drilling	23	Cutter making	27
Lathe	25	Heavy drilling	34
Milling	25	Jig and fixture making	37
Cam cutting	26	Cutting off	43

Table II.—Comparative Factors to Consider

Group Drive	Individual Drive
Constant friction loss in shafts and belting.	Friction loss in motor and machine when operating only.
Control of speed limited by the number of cone pulley steps.	Control of speed limited only by the number of notches on the controller and by the gear ratios.
Reversing must be accomplished by a clutch or by crossed belts.	Reversing may be accomplished by the handle of a controller.
Difficulty in stopping the machine tool at any given point.	The machine tool can readily be stopped at any desired point.
Speed increments are usually large.	The speed increments may be made as small as desired.
The size of the cut is limited by belt slippage.	The size of the cut is limited only by the mechanical strength of the machine and by the motor torque.
Difficulty is experienced in locating causes of delay in the work.	Delays in the work may easily be detected by the use of the graphic meter.
Changes in the location of machinery difficulty because shafts are fixed in position.	An individually motor-driven machine may be moved readily to suit the convenience of production.

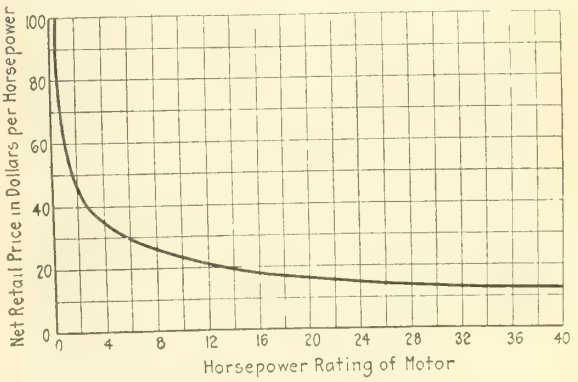


Fig. 2.—Approximate variation in cost per horsepower for different-size motors.

The first cost of an individual-motor drive for this same floor was estimated at about $10,400 per floor, proportioned as follows: For the 136 motors, 83 per cent. of the first cost of the driving system, and for wiring, etc., about 13 per cent. The losses due to friction in this case were estimated at $700 per annum. In this instance the extra first cost of the individual motors amounts to $1,700, whereas the saving in frictional or mechanical losses by the use of individual motors amounts to about $1,800. In such a case, therefore, the increased cost of the individual-motor system would pay for itself through reduced mechanical losses in approximately a year's time.

The principal advantages are power savings (already discussed) and increased production. The latter is brought

about largely by cutting down the time required to perform some or all of the elements which constitute the cycle of the operation. Thus the cycle for a planer includes the time required for (a) the cutting stroke, (b) bringing the platen to rest, (c) reversing the platen, (d) the return stroke, and (e) again bringing the platen to rest and starting in on the cutting stroke. The analysis of the operation of such a machine is largely one of studying how each of the components of the cycle may be affected by the individual motor in comparison with the countershaft or group drive, keeping in mind that a 20 or 40 per cent. saving in the time required for such a cycle means (according to Fig. 1) a corresponding percentage saving in the total cost of production. Obviously, any appreciable saving in the total cost of production by a given machine tool will be an item of great importance to the efficiency of the plant and will be of a magnitude which is far greater than any corresponding percentage saving in the power consumption of the same machine.

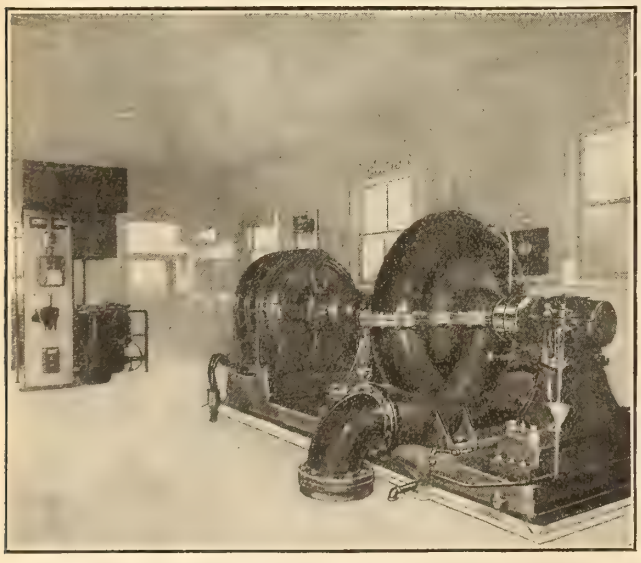
The author sums up the relative advantages in Table II.

Pumping Plants Have Equipment Designed for Flexibility

The motor-driven centrifugal pumping plant recently completed at the Riverdale station of the corporation of Toronto is of interest to municipal and other engineers, owing to the great flexibility of speed and capacity of the unit. It was designed to deliver 5,000,000 imperial gallons in 24 hours, against a head of 170 feet, and running at a speed of 720 r.p.m., but owing to probable variation in pressure and capacity the city required the unit to deliver either 3,000,000 gallons or 1,000,000 gallons against a lower head varying from 130 ft. down to 70 ft.

Single Stage Pump With Variable Speed Motor

Under such conditions it is usual to build a multi-stage pump, but the contractors, Canadian Allis-Chalmers, designed and built a single-stage pump which has fulfilled all the guarantees required by the city. The usual practice also is to supply constant speed induction motors for centrifugal pumps, but as the speed to fill the above requirements must vary from 720 r.p.m. down to 50 r.p.m., the Canadian General Electric Company built a special 250 h.p. variable speed motor, which also fulfils all the requirements of the city.



Unit at Riverdale pumping station, Toronto.

This pump is single-stage, split casing, specially designed and constructed to obtain the highest efficiency. It consists of a cast-iron spiral casing with discharge and suction inlet cast on to the lower body. The casing is split on a horizontal centre line, so as to facilitate inspection without dismantling pipe or any other part of the unit.

A set of removable diffusion guide vanes has been provided so as to guide the water from the impeller to the casing in the most efficient manner. The impeller is made of cast bronze, and is polished so as to eliminate unnecessary friction.

Special neck rings have been provided, so as to decrease the leakage water from the pressure side to the suction side. The impeller is of double suction type and the head of 170 ft. is generated in a single stage.

Proper stuffing boxes are arranged on each side of the extending shaft, and bronze sleeves are provided so as to eliminate rust and undue wearing. The shaft itself is made of the best hammered steel and of ample design to prevent any vibration.

Outboard Bearings for Shaft

Separate outboard pedestal bearings are provided in order to carry the shaft, and one of these bearings is arranged with forged collars, which act as a thrust bearing in order to take care of any unbalanced thrust which might occur occasionally. All bearings are arranged for water cooling, and are of the self-aligning ring oiling type.

Separate sub-bases are provided to facilitate dismantling and direction. Both bearings are tied up to the main pump casing by means of stay bolts, so as to make the whole unit as rigid as possible.

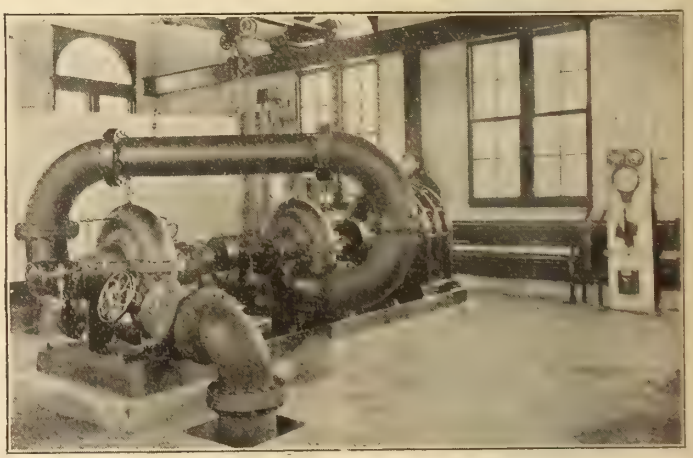
A flexible pin type coupling is arranged for connecting up this pump with the motor. The whole unit is set upon a heavy cast-iron base plate, which is grouted in to the foundation.

The unit has proven to be exceedingly quiet during operation, a point insisted upon in the specification, and to be well over 70 per cent. in efficiency at various tests, and operating under various conditions, which is notable for a single-stage type pump of such comparatively slow speed.

Test of Motor Driven Pumping Unit

The motor-driven centrifugal pumping unit recently installed by Canadian Allis-Chalmers, Limited, at the Papineau Avenue pumping station, Montreal, was tested by engineers on behalf of the Corporation on November 29, 1917, and gave a combined overall efficiency of 75.8 per cent. at three-quarter load to 79 per cent. at overload. The pumps themselves showed an efficiency of 81.5 per cent. to 84.9 per cent.

This unit is composed of two 12-in. type "S" A-C centrifugal pumps and one C. G. E. Co. type I.6—525 h.p., 1,260 r.p.m., Form P, 2,200 volts, 3 phase, 60 cycles, wound rotor induction motor, complete with drum type controller and resistance for two minutes starting duty, and with incoming line panel on which is mounted oil switch and instruments



Papineau Ave. pumping unit, Montreal

The pumps are connected in series by means of a cast

TABLE I.—OFFICIAL TEST, PAPINEAU AVE. PUMPING STATION MONTREAL

PUMPS								MOTOR							
Speed R.P.M.	Vent. Meter M.G.D.	G.P.M.	Head Delivery Lbs.	Head Delivery Feet	Suction Lbs.	Suction Feet	Total Feet	Water H.P.	Amp.	Volts.	Watt Meter K.W.	Input Elec. H.P.	Eff.	B.H.P.	Pump Eff.	Combined Eff.
1250	6.1	4236.1	150	346.5	3.25	7.5	339.0	435.16	116	2330	428	573.72	93	533.56	81.5	75.8
1220	6.450	4479.1	143	330.33	1.9	4.39	325.94	442.4	116	2310	418	560.3	93	521.1	84.8	78.9
1217	6.830	4743	135	312.0	1.0	2.31	309.6	444.9	117	2310	420	563.0	93	523.59	84.9	79.0

Remarks: Max. Temp. Motor iron, 44 degs. C.; Coils, 38 degs. C.; Room, 25 degs. C.
Water measured by manometer Venturi meter.

iron overhead pipe. A decided advantage in adopting this arrangement is the accessibility of all parts during operation, especially such as bearings, couplings, and impellers of the pumps. All bearings are of the self-oiled type, and no bearings are employed inside of any of the pumps. The official test is recorded in Table I.

Personals

Mr. Stanley G. Johnstone has been appointed assistant inspector of gas and electricity for the district of Toronto.

Mr. George Garrett, master mechanic with the Winnipeg Electric Railway, has been appointed superintendent of rolling stock.

Mr. W. S. Hart has been appointed managing director of the Three Rivers Traction Company, Three Rivers, Que. He was formerly secretary-treasurer and general manager.

Mr. G. A. Mills has been appointed electrical engineer of the Winnipeg Electric Railway Company. He was formerly electrical engineer for the Waterloo, Cedar Falls and Northern Railway, Waterloo, Iowa.

Major Harold L. Trotter, A.M.C.S.C.E., has been awarded the D. S. O. Major Trotter, who has been at the front for about two years, with the Canadian Engineers, was associated with Mr. Henry Holgate, consulting engineer, Montreal, for about ten years.

Mr. E. B. Fewings, who has been for six years with the Hydro-Electric Commission of Galt, Ont., the last three years as chairman, has retired. He was presented by the Hydro staff with a handsome easy chair and an address of appreciation was read.

Mr. M. E. McCormick has been appointed assistant to general manager of the New Brunswick Power Company, operating the St. John, N.B., street railway. He was formerly assistant general manager of the Bangor Railway and Electric Company, at Bangor, Me.

Mr. W. S. Ford, Lieut., Royal Garrison Artillery, 122nd Siege Battery, B.E.F., who has been elected an associate member of the Canadian Society of Civil Engineers, was formerly assistant hydraulic engineer with the Canadian Boving Company, designing water power plants, Diesel engine plants, etc., and also with the Western Canada Power Company, Stave Falls, B.C., on power house construction, waterways, surveys, etc.

Mr. W. R. Bonnycastle, of Vancouver, has been elected a member of the Canadian Society of Civil Engineers. He is in practice as a consulting hydro-electrical engineer, specializing on water power development, and is also engineer for the Bridge River Power Company and the Indian Power Company, B.C. Besides being connected with Mr. R. S. Kelsch, of Montreal, on the design of the Kaministiquia Power development, Fort William, Mr. Bonnycastle was electrical engineer with the Stave Lake Power Company, designing engineer with the Western Canada Power Company, and engineer for Smith, Kerry and Chace.

New Books

Radio Communication—theory and methods, with an appendix on transmission over wires, by John Mills, research department, Western Electric Company; McGraw-Hill Book Company, Inc., New York, publishers; price $1.75 net. This book is the substance of a course of lectures given by the author during the summer of 1917 to a company of the United States Reserve Signal Corps. As the individual men differed widely in the extent of their previous training, treatment of the subject involved practically no mathematics. The scope of the work is shown by the following chapter headings: Alternating Currents; The Telephone Receiver; The Vacuum Tube; Detection of High Frequency Currents; Production of Damped Sinsuoidal Currents; Production of Undamped Hugh Frequency Currents; Radio Telegraphy and Telephony; Practical Appliances and Methods of Radio Telegraphy; Transmission over Wire Circuits. The book contains 205 pages, well illustrated; size 5 by 7 inches.

Central Stations—by Terrell Croft; McGraw-Hill Book Company, Inc., New York, publishers; price $2.50 net. After a general treatment of certain elements which occur in all electrical energy distribution systems, the different factors which are utilized frequently in central station practice are discussed more exhaustively. These include load factor, demand factor, diversity factor, plant factor and the like. Next the typical load curves encountered in everyday work are considered; then principles of circuit design, with examples showing how circuits are computed in practice. Chapters follow treating with transmission and distribution, lightning protection equipment, etc. The final chapters in the book are concerned with electrical energy generating stations and the equipment of such stations. These include a study of automatic voltage regulators, switchboards, switchgear; the three different types of prime movers—steam, internal combustion engine and hydraulic; reactors and transformers, etc. The book is in the standard dark green binding of this publishing house; 330 pages; well illustrated; size 5½ x 8 inches.

The Lighting Art—its practice and possibilities, by M. Luckiesh, physicist, Nela Research Laboratory, National Lamp Works of General Electric Company; McGraw-Hill Book Company, Inc., New York, publishers; price $2.50 net. The purpose of this book is to discuss lighting problems, particularly from an unusual standpoint. It is pointed out that engineering and scientific data may be found elsewhere in great abundance, so that the chapters are confined to discussions of scientific and artistic aspects of lighting, with the aim of indicating greater possibilities in the use of light This is a book which will be found of great value, not only to illuminating engineers, but, on account of its non-technical character, to the architect or layman interested in the science of better illumination. It contains 230 pages; size 6 by 9 inches; bound in the standard dark green cloth of this publishing house.

Electric Railways

Montreal Tramways Company Has New Double-Unit Cars in Operation—Control from Master Controllers in Vestibule

The Montreal Tramways Company has just put into operation a portion of 100 new cars, constructed by the J. G. Brill Company, Philadelphia. These are of the double unit type, similar to some now in use except in a few minor details. The trucks and bodies were made in Philadelphia, the cars being assembled and the electrical equipment fitted in the Tramways Company's shops at Youville, near Montreal.

The following gives the main features of the cars:—

Weight, total	motor, 45,000 lbs. trailer, 38,000 lbs.
Seating capacity	motor, 42 trailer, 45
Bolster centres	motor, 21 ft. trailer, 21 ft.
Length over bumpers	motor, 45 ft. 3 ins. trailer, 44 ft. 3 ins.
Length over vestibule	motor, 44 ft. 3 ins. trailer, 43 ft. 3 ins.
Width over all	8 ft. 5 ins.
Rail to trolley base	11 ft. 4½ ins.
Body	Steel with wood posts.
Interior trim	Cherry
Headlining	Agasote
Roof	Arch
Air brakes	Westinghouse
Heaters	Consolidated car
Fare boxes	Coleman stationary.
Lightning arresters	Canadian Westinghouse.
Motors	Canadian Westinghouse 533-T-4; motor cars, 4; trailers, 2; outside hung.
Control	Westinghouse P.K. multiple.
Couplers	Tomlinson.
Designation signs	Keystone.
Seating upholstery	Rattan.
Trolley retrievers	Keystone.
Trucks, type	76 E.
Wheels	Standard cast iron, 30 in.

The cars have the usual fenders, sanders, hand brakes, heat regulators. The air brakes can be applied by either motorman or conductor, while should the cars be accidentally separated the brakes automatically come into operation. The automatic equipment is operated from storage batteries,



Front vestibule new Montreal cars.

making its operation independent of the usual power, and continuous in the event of the current being off. The electric heaters are controlled by a thermostat, with an automatic switch to maintain an even temperature.

The great feature is in the matter of the controller. In the other cars of the company the main controller is in the motorman's vestibule, whereas in the new train both cars are controlled from a master controller placed in the vestibule of either car. In other words, the cars constitute a multiple train which can be run either as a single unit or as a double unit. The use of this Westinghouse type P.K. control also has the advantage of allowing the removal of



Typical new double-unit train of Montreal Tramways Company.

all heavy current carrying parts, and eliminating burnouts in the vestibule. Additional space is also given on the platform, the weight of the latter is reduced, the car wiring is minimized, and greater facility allowed for the application of automatic emergency features on master controllers. It is intended to run these cars on the steeper grades, which hitherto it has not been possible to do to any extent with the other double unit cars.

Each front car is equipped with four Canadian Westinghouse motors, and each trailer with two motors. The total power per double car is 330 h.p., but 600 h.p. can be developed for short periods, 400 h.p. being necessary to operate on the heavier cross town grades. Lighting is by 94 watt lamps with reflectors and automatic compensating device for burned out lamps.

As will be seen from the cut the entrances and exits are of ample proportions, there being a separate exit in the motorman's vestibule of the leading car; the main entrance and exit of this car is at the rear, while those of the trailer are at the front. The doors are interlocked with the power system, making it impossible for the cars to be started until all doors are closed. This prevents accidents to passengers attempting to board cars when the vehicles are in motion.

The experiment with the double cars has proved so satisfactory that the additional cars have been ordered. In a city like Montreal, with its congestion of traffic at rush hours, it is important that the company should be able to transport passengers quickly, avoid delays at intersections, and give facilities for the motorman to move quickly between stops. Of course, other considerations, such as number of stops, enter into the question of efficient service, but in regard to the points previously mentioned, it is claimed that the two unit cars effectively deal with the problems. It is manifest that the double unit cars will carry a much larger number of passengers; that the two cars can receive their loads and discharge the passengers practically in the same time as a single car, given the requisite entrances and exits; that there is less likelihood of delay at the cross sections; and that with fewer vehicles on a route the cars can attain quicker speeds between stops.

Electric Railway Conditions in Halifax

The electric situation in Halifax is described in the current issue of the Electric Railway Journal, who despatched a representative to the scene of action immediately after the disaster. The following extracts are of special interest:

In general, the Nova Scotia Tramways and Power Company's power plant equipment and repair shop proved almost immune from damage, excepting the destruction of windows and doors from the concussion. As might be expected, the rolling stock of the company suffered considerably where it was in service on the streets. Five platform men were killed in the performance of their duties and four of the company's outside mechanics lost their lives. As yet it is impossible to tell how many laborers succumbed. Out of forty box cars in service thirteen are in first-class condition. Two were so badly damaged that they will have to be completely rebuilt. Twenty-five others suffered minor injuries, such as broken windows, door frames blown out or in, warped bodies, etc. One car body was torn off its truck and landed upon a sidewalk at the north end of the city.

Fortunately for the company, very little damage was done to track and roadbed on the system as a whole. The company operated only about one mile of track (60-pound Lorain T-rail) in the worst part of the explosion zone, and this appears not to be in very bad shape. A few cars were started out on the system Friday morning, but unfortunately a blizzard descended upon the city. Automobiles and cars became stalled, and it was impossible to resume passenger service until Sunday morning. On Saturday night 150 United States bluejackets assisted the tramway company in track cleaning. Managing Director H. R. Mallison states that the aid rendered by these men enabled considerable progress to be made in the direction of opening the system for traffic, and that their unstinted service will never be forgotten either by the citizens or by the company. Eight cars were in operation by 10.20 a.m. Sunday. The railway distribution system was not seriously damaged except in the districts closely involved in the explosion. The company is well supplied with line material of all kinds, but is short of car carpenters and glass.

The explosion destroyed the greater part of the overhead lines in the so-called Richmond district of Halifax, as well as in Dartmouth. Breaks and short-circuits in the distribution system of the Tramways and Power Company necessitated the shutting down of the generating plant for a short period, but within an hour the station was again supplying energy through all parts of its territory outside the explosion zone. The fall of overhead circuits, trolley wire, and feeders opened a large number of automatic breakers and switches at the power plant. Practically all the windows and doors on the north side of the station were blown into the building, debris scattering about the operating room for a distance of 40 to 50 feet from the wall. As in many other parts of the city, the tremendous air currents set in motion by the explosion wave knocked down some of the employees. None of those in the station, however, was seriously injured. The windows on the north side of the station were of wired glass, set in steel sashes, but these were blown to bits by the force of the blast. A large amount of glass was blown into the motor-generators near the north wall, and the railway switchboard was also subjected to a shower of this material. Little damage was done, however, either in the station or in the adjacent car repair shop of the company. The boiler-room suffered little, if at all.

Many of the short-circuits on the distribution system were quickly burned out. As soon as possible after the explosion the company's line superintendent and two men proceeded to the vicinity of the North Street station (the Halifax railroad passenger terminal) and cut clear across the city, beginning at North Street, all the overhead lines of the company entering the devastated district. This work was completed during the afternoon.

Prior to the disaster the average peak load upon the power station was 3,100 kw., but the curtailment of demand resulting from the destruction of so large an area has reduced this to about 1,500 kw.

Women Conductors in New York

Women conductors are being used on the New York surface car lines, replacing a large number of men who have been removed by war demands. At present there are about seventy-five in the service, and this number will be gradually increased as positions are left vacant and the women are trained. There is no intention of using women as "motormen." The women will work the same hours as the men they replace and will begin at the same rate of pay. Applications are favored from relatives of men who have enlisted for military service.

When an applicant is accepted she is placed in a school for about two days and afterwards undergoes a test covering familiarity with the company's rules, making change, etc. A certain physical standard is required. During the first few days an instructor accompanies the new conductress.

Standard uniforms have been adopted, made of khaki cloth, similar to the army color. The coat reaches almost to the knees, and has four pockets and a lower inside pocket for carrying transfers. The collar is so made that it can be buttoned in three different positions.

The Dealer and Contractor

Relationship of the Contractor to the Central Station

By W. R. Putnam*

What I am about to present to you I hope you will take in the spirit of co-operation in which it is given. There is no question but what there has been a wonderful change in viewpoint during the past generation. To-day men have a realization that a successful undertaking is impossible in all kinds of industries unless you have the confidence and co-operation of the several branches of the industry. The success of central station undertakings is primarily dependent upon increased business, and no central station can be successful in increasing business unless it has the assistance of all branches of the industry. It cannot work alone, consequently it seems advisable to discuss frankly with the contractors and dealers at this time many of the problems that concern the central station. The central station is first dependent upon the good-will of its customers and, second, upon the good-will of the dealers and contractors in its territory. I appreciate thoroughly that such is the case after having spent some twenty years in the industry, and having worked up to the time where we are securing this co-operation.

Central Station Responsibility

The central station industry has as its responsibility the most extensive use of electrical service, in the territory it is serving, that is possible. That is our aim. We, of course, are employing men whose business it is to secure this business. We have the same responsibility to our stockholders that you have to your stockholders. We must consider the money invested in our business that is entitled to a fair return.

Co-operate to Prevent Stagnation

One place where contractors and dealers can co-operate with the central station is in connection with this situation. You undoubtedly will be interested in knowing that my company did not earn 6 per cent. on the money invested in its business during the past year. This is too small a rate of return. The only way that this can be increased is either by increasing business or by increasing the rates at which current is sold. The central station industry has been affected by the advance in cost of materials the same as your business has been affected, with this difference, that we are not in position to as readily raise rates as are you people. Possibly we will not be able to increase our business to the point where we can pay the increased cost of materials and labor and at the same time pay a reasonable rate of return on our investment. If such a condition happens, you men can be of wonderful assistance in helping the power company to secure whatever raise in rates may at that time be found necessary. You will owe it to yourselves as well as the central station to render this aid as a central station in your territory which is in financial straights will be unable to finance the necessary power developments and extensions to care for increased business, with the result that there will be stagnation so far as the electrical industry in its territory is concerned, which would result in decreased business for all of you men.

Leave Installations to Contractors

In reference to division work between the various branches of the industry the contractor and dealer should, without question, handle installation work in this territory. They also should be very active in the merchandising of all electrical goods, including lamps and appliances. At present you men are handling practically all of the installation work on customers' premises, except in some of our small towns where you are not equipped for this work. As a result, it is our intention to keep out of this class of work. We also aim to have the sale of motors in our territory handled by the contractors and dealers.

Financial Support

As you know, we have assisted contractors and dealers in financing installation work from time to time, particularly with all house wiring. I will grant that we are not doing as much as we might in this respect, but, unfortunately, the central station industry has been hit harder than any other branch of the industry in the present financial situation. We cannot secure money for extension work out of our earnings. We must secure new money to finance all extension work, and money is not to be had at this time. Undoubtedly when financial conditions reach normal we will be able to render you more assistance in financing deferred payment sales of larger appliances.

Will Never Reach Saturation Point

Probably the largest field for additional work on your part is in the sale of additional wiring, fixtures, and appliances for use in the home. We all are interested in securing the greatest saturation possible. However, saturation, as far as the use of electricity is concerned, will never be obtained. There are unlimited possibilities for the electrical industry. We owe to our customers, as well as to our stockholders, the securing of this business, so that our customers will have better and more convenient homes. The central station in its advertising is trying to impress upon its customers, as well as prospective customers, the very many ways in which electric current can be advantageously used by them. This opens up the way for business on your part. The central station has felt that it was necessary for it to take a very active part in this class of merchandising, and I appreciate that this activity on the part of the central station has opened the central station to criticism by you men. However, you must appreciate that our duty requires us to adopt the quickest method of securing this business in order to increase our kilowatt hour sales.

Tremendous Growth in Merchandising Business

Our company has been operating some five years in this territory. Our merchandising business for the first year amounted to $97,000. The first eight months of last year we

* Sales Manager of Utah Power and Light Company, before Utah Society of Electrical Contractors and Dealers.

showed an increase of 63 per cent. over the first eight months of the previous year, and our total merchandise sales for the year will reach approximately a half-million dollars. There is no reason why all of you men should not have increases in your business in approximately the same proportion if you had taken advantage of the conditions. I know that the jobbers, although we buy a considerable portion of our merchandise direct from manufacturers, have had very remarkable increases in business in this territory during this period.

Central Station Publicity Aids General Situation

The contractors and dealers in this territory are not at present properly equipped to handle this merchandising business. You are not ready to spend the amount of money every year required for advertising purposes; you do not have proper display rooms; you do not give the attention to window dressing that is required, and do not have the floor salesmen and other facilities to take care of this volume of business. However, if you have followed the central station advertising you will note that the bulk of their advertising is directed to the education of the consumer as to the advantages of the use of electrical appliances and conveniences. This advertising does not aim primarily to secure this business for the central station, but endeavors to convince the customer of the advisability of purchasing appliances, of the use of better lighting, and of all other types of electric service.

Contractors Should Profit

There is no reason why you contractors and dealers cannot secure very valuable assistance from this advertising of the central station. Allow the central station to continue the work of educating the public and centre your advertising, which need not be nearly as extensive as the central station's, upon directing the attention of electric customers to your store as an electrical centre. Endeavor to secure as permanent customers purchasers who will form a habit of using your store as their electrical centre, their place for solving their electrical problems, and the place at which they will make their purchases of all electrical goods. The greater number of such centres to be established in our territory the better we will be pleased.

Improve Appearance of Store and Windows

You men should gradually improve the appearance of the sales floor of your stores, and particularly of your windows. I appreciate the fact that most of you, in paying a high rent for your stores, are paying a considerable portion of that money for location, and you are wasting that part of your expenditure if you do not take advantage of the location with attractive windows, changed frequently, and with arrangement of goods on your sales floor that has drawing power.

Possibly you have seen the analysis of conditions in San Francisco, recently published. There it has been ascertained that the department stores are doing more electrical appliance business than all of the electrical stores in San Francisco. A similar condition is gradually developing in this territory, and it behooves you men to exert your utmost efforts if you wish to continue the electrical merchandising business.

Fifty Dollars Per Household

In reference to the amount of merchandising business that may be obtained in our territory, there is no reason why every household located where electric service is available should not spend fifty dollars per year for electrical equipment. In this state alone there are from sixty to sixty-five thousand homes using electric service. This means that at least three million dollars a year in wiring, electrical merchandise, and electrical supplies should be secured from these customers. I doubt if one-third of that business is now done in this territory; consequently, there is an immense field for development for new business here, and it does not seem wise for any of us to quarrel over the question of who is entitled to this business, as long as we are securing only a portion of the total possible business.

Maintain Prices

The central station in this territory will continue to cooperate with the dealers in maintaining list prices. We know that no other course is advisable, except in connection with special campaigns. Good merchandising calls for these campaigns. If we are to be successful in merchandising we must to a very considerable extent, adopt department store methods for this portion of our business.

School Building Lighting Code

When you consider that every prospective citizen of our Dominion spends on the average the working part of some ten years of his life in school; that to many pupils school work at best is a highly nervous strain and, finally, that school children themselves have no inherent ideas of conserving their eyesight, we surely have sufficient reason for demanding that the natural lighting of our schools should not only receive every consideration, but that it should be supplemented, on such days and at such periods of the day as natural illumination may prove inadequate, by the most approved aids in the way of artificial lights.

Realizing, as no other body of men can, the prime importance of this feature in our system of elementary education, the Illuminating Engineering Society have prepared a Code of Lighting for School Buildings, extracts from which we reproduce below. While this Code is intended primarily as an aid in formulating legislation relating to the lighting of school buildings, it is also intended for school authorities, architects, contractors and others, as a guide in individual efforts to improve lighting conditions:

The desirable illumination to be provided and the minimum to be maintained are given in the following table,[1] being based upon present ideas of good practice.

Desirable and Minimum Illumination

	Artificial Lighting Foot-candles (Lumens per sq.ft.)* at the work	
	Minimum	Ordinary practice†
Storage spaces	0.25	0.5- 1.0
Stairways, corridors	0.5	1.0- 2.5
Gymnasiums	1.0	2.0- 5.0
Rough shop work	1.25	2.0- 4.0
Auditoriums, assembly rooms	1.5	2.5- 4.0
Class rooms, study rooms, libraries, laboratories, blackboards	3.0	3.5- 6.0
Fine shop work	3.5	4.0- 8.0
Sewing, drafting rooms	5.0	6.0-12.0

*It should be borne in mind that intensity of illumination is only one of the factors on which good seeing depends.

†Under the column headed "Ordinary practice," the upper portion of the range of intensities is preferable to the lower; where economy does not prohibit, even higher intensities than those cited are often desirable.

‡The illumination intensity should be measured on the important plane which may be the desk-top, blackboard, etc.

Glossy Surfaces and Eye-Strain

Glossy surfaces of paper, woodwork, desk-tops, walls and blackboards, are likely to cause eye-strain because of specular or mirror-like reflection of images of light sources,

The following table shows the order of magnitude of the brightness of some light sources in common use:

	Brightness (approximate millilamberts)
Indirect lighting: ceiling, directly above the lighting unit	5. to 75.
Semi-indirect lighting: heavy density glassware	35. to 100.
Semi-indirect lighting: light density glassware	200. to 1,000.
Direct lighting: 10 in. (25 cm.) opal glass ball containing 100-watt vacuum tungsten lamp at center	500.
Direct lighting: vacuum tungsten lamp, (frosted) in open bottom reflector	2,000. to 3,000.
Vacuum tungsten lamp, filament exposed to view	500,000.
Gas-filled tungsten lamp, filament exposed to view	2,000,000.
[illegible]	15,000
Gas-mantle, concealed in 6 in. (15 cm.) opal glass globe	1,000
[illegible]	8,000
Daylight: clear blue sky	1,000.

especially when artificial light is used. Matte or dull finished surfaces are recommended. It is to be noted that a high reflection factor does not necessarily imply a polished or glazed surface.

To minimize eye-strain it is recommended that unglazed paper and large plain type be used in school books. It is recommended that lighting units be of low brightness.

Design of Lighting Installation

The illumination intensity on the horizontal working plane should be as uniform as possible. The variation should not be greater than 4 to 1.

Approximate Coefficients of Utilization—Modern Lighting Equipment

	Light color walls Light color ceiling	Medium color walls Light color ceiling
Small Rooms (Offices, Corridors, etc.)		
Direct lighting; dense glass (open bottom reflectors)	0.40	0.35
Semi-indirect lighting; dense glass	0.25	0.22
Indirect lighting	0.23	0.20
Medium Sized Rooms (Class Rooms, Laboratories, etc.)		
Direct lighting; dense glass (open bottom reflectors)	0.50	0.45
Semi-indirect lighting; dense glass	0.35	0.30
Indirect lighting	0.30	0.25
Large Rooms (Auditoriums, etc.)		
Direct lighting; dense glass (open bottom reflectors)	0.60	0.60
Semi-indirect lighting; dense glass	0.45	0.40
Indirect lighting	0.40	0.38

[2] The flux is measured in lumens. A lumen is the unit of light flux and is the quantity of light required to illuminate 1 square foot of area to an average intensity of 1 foot-candle.

The chief factors which must be considered in arriving at the size and number of lamps to be used in a given room are (1) the floor area; (2) the total luminous flux[2] emitted per lamp, and (3) coefficient of utilization of the particular system considered. The first should be measured in square feet. The second may be obtained from a data book supplied by the manufacturers of lamps. The third involves many factors such as the relative dimensions of the room, the reflection factor of the surroundings, the number of lighting units and their mounting height, and the system of lighting. By coefficient of utilization is meant the proportion of the total light flux emitted by the lamps which is effective on the working plane. In the accompanying table approximate coefficients of utilization for modern lighting equipment are given. The working plane in this case is a horizontal plane 30 inches above the floor. These values refer to the initial installation without any allowance for depreciation.

Determining Size and Number of Lamps

For determining approximately the size and number of lamps to be used in a given room by means of the coefficients of utilization given in the preceding table, it is necessary to know the luminous output in lumens per watt for the electric lamps considered or in lumens per cubic foot of gas consumed per hour if gas lamps are considered. At the present time (1917) the light output of tungsten filament electric incandescent lamps, based on average service conditions of regularly maintained installations, ranges from 8 lumens per watt for the smaller vacuum tungsten lamps to 14 lumens per watt for the larger gas-filled tungsten lamps employed in school lighting. For incandescent gas systems similar service values range from 150 to 250 lumens per cubic foot of artificial gas consumed per hour. The computation for the total lumens required to give a certain illumination intensity in foot-candles is as follows:

N = number of lamps.

L = lumens output per lamp.

E = coefficient of utilization.

A = area of floor or horizontal working plane in square feet.

I = illumination intensity in foot-candles.

Then $I = N \times L \times E/A$

that is, the number of lamps multiplied by the output per lamp in lumens, multiplied by the coefficient of utilization, divided by the area of the horizontal working plane in square feet, gives the illumination intensity in foot-candles.

If the size of the lamps is to be ascertained the computation is made thus:

$$L = \frac{I \times A}{N \times E}$$

To illustrate by an example, assume a room, whose floor (also working plane) is 30 ft. by 18 ft. (9.1 by 5.5 m.), to be lighted by a semi-indirect system from six fixtures containing one lamp each. It will also be assumed that the ceiling is highly reflecting, the walls moderately reflecting, and the illumination intensity desired is 5 foot-candles. The luminous output required of each of the six lamps will be found by substituting the assumed values in the equation, thus:

$$L = \frac{5 \times 30 \times 18}{60 \times 0.30} = 1{,}500 \text{ lumens}$$

Allowing a depreciation factor of 20 per cent. as representing a well maintained installation, the lumens actually required would be 1,500/0.8 = 1,875 lumens. If gas-filled tungsten lamps are considered, whose average output under service conditions is 12 lumens per watt, it is seen that a 150-watt lamp in each fixture will give the desired results.

If gas mantle lamps are considered, whose average output in lumens under service conditions is 250 lumens per cubic foot of gas consumed per hour, it is seen that a lamp consuming 5 cubic feet of artificial gas per hour will be satisfactory in each fixture.

The above example is intended solely to illustrate the method of computation. Estimates of the illumination intensity obtained from an actual installation may also be made by a similar computation.

With the usual lighting equipments the distance between the units should not exceed one and one-half times the height of the apparent source of illumination above the working level.

Edison Electric Appliance Company

Incorporation is announced of the Edison Electric Appliance Company, Inc., under the laws of the State of New York. This company takes over as of January 1, 1918, the Hotpoint Electric Heating Company and the Hughes Electric Heating Company (with the exception of certain foreign rights, particularly the Canadian business of these companies), and the domestic or household heating device business of the General Electric Company. The industrial heating device and furnace business will not be transferred by the General Electric Company to the new company.

The new company, it is announced, will devote itself actively to the question of standardization of the various devices, which, it is believed by the incorporators, will lead to greatly improved commercial conditions in the distribution of these products by central stations, jobbers, dealers, and other distributing agents.

The new company will operate three manufacturing plants—the Hughes factory at Chicago and the two Hotpoint factories, one at Chicago and one at Ontario, Cal. The General Electric Company's heating-device manufacture now carried on at Pittsfield will be removed to the Hotpoint and Hughes factories at Chicago. Commercial headquarters of the company will be at Chicago. The board will consist of Willis H. Booth, chairman; George A. Hughes, president; A. K. Baylor, vice-president; E. H. Richardson, A. F. Vaughan, G. F. Morrison, C. E. Patterson, and H. C. Houck. W. H. Booth and E. H. Richardson are at present officers of the Hotpoint Company and Messrs. Hughes and Vaughan of the Hughes Company. P. H. Booth, now sales manager

of the Hotpoint Company, will act as sales manager of the new company. The complete factory, engineering, and commercial forces of the Hotpoint and Hughes companies will go over to the new company. Certain of the commercial and engineering representatives of the General Electric Company's heating-device department will go with the new company. This list will include J. D. A. Cross, who has charge of the General Electric Company's heating-device sales, and C. P. Randolph, engineer in charge of heating-device production at Pittsfield, who will both be stationed at Chicago.

It is probable that the new company will continue to sell the three distinct lines of product, namely, the Hotpoint, Hughes, and General Electric devices and ranges.

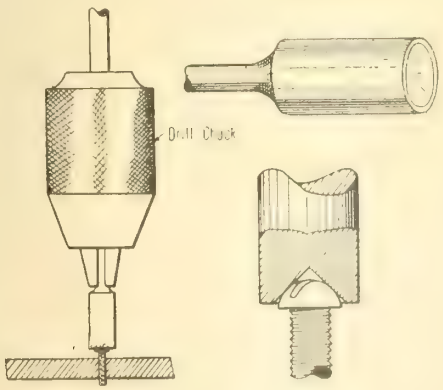
Economy Buys "Arkless" Fuse

An announcement of interest to the electrical industry and to all users of fuses, is made in a letter addressed to the trade stating that the entire fuse business of the Detroit Fuse & Manufacturing Company, makers of the well-known and long established line of "Arkless" enclosed fuses, has been purchased by Economy Fuse & Manufacturing Company, Chicago. The transaction includes the conveyance of all merchandise, materials, machinery, tools, designs, patents, goodwill and unfilled orders. The physical assets of Detroit Fuse & Manufacturing Company, insofar as they pertain to the making of fuses, have been shipped to the Chicago plant of Economy Fuse & Manufacturing Company, where the manufacture of "Arkless" fuses will be continued, production being, as heretofore, under the label service of Underwriters' Laboratories, Incorporated. The same organization will now produce "Arkless" Non-Renewable Fuses—"The fuse with the 100 per cent. indicator"—one of the oldest standard fuses on the market, and Economy Renewable Fuses, the pioneer fuse of the renewable field. Arrangements made well in advance enable Economy Fuse & Manufacturing Company to take over the "Arkless" fuse business without interference with deliveries of either "Arkless" or "Economy" fuses.

It is to be well noted that the "Square D" line of enclosed safety switches remains the property of Detroit Fuse & Manufacturing Company, who will concentrate on its production and marketing.

Driving Round Head Screws

The Electrical Review prints an item by H. B. Stillman describing a device used for driving round-head screws. This device is made by taking a brass or iron rod ⅝ or ¾ in. diameter and counter-sinking one end just deep enough to fit the head of the screw. The drill used in counter-sinking should be sharp at the point so as to leave a conical



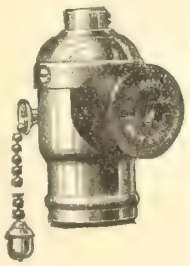
hole. A few notches filed in the cone will give the tool a better grip. The writer says that if the screws have a nickel or polished surface which it is desirable to retain, the tool may be made of fibre, in which case there will be practically no danger of marring the finish. This method is said to be much safer than a screw-driver blade, since the latter will often slip out of place and scrape the work.

Best "Jiffy Junior" Attachment Plug

A new solid attachment plug, called the "Jiffy Junior," has just been put on the market by the Best Electric Company, of Pittsburgh, Pa. The "Jiffy Junior" is a solid piece (with separate tip) of asbestos composition. The terminals are moulded right into the plug, and the brass screw shell is die stamped permanently into place, giving it a most substantial construction. By loosening one screw, the tip is removed and the plug is open for wiring. The wires are then cut to even lengths; no knots are necessary, as the right angle strain reliefs securely hold the wires. This plug has the advantage of being quick and easy to wire. It is wired in the open; one screw holds the plug together secure. Its simple design makes it impossible to wire or assemble wrong, and also makes it a practical plug of great economy. Being made of asbestos composition, the plug is, claimed to be indestructible, and is a safe plug to use with any device.

New Hubbell Series

Harvey Hubbell, Inc., are now placing on the market a pull-socket current tap. The device is of the same mechanical construction as the ordinary pull socket, to which has been added a plug receptacle built into the side of the body. It can be supplied with a ⅛ in., ¼ in., ⅜ in., or pendant cap. The flow of current to the lamp base is controlled by the pull-chain. The terminals of the receptacle are continuously in circuit. The use of this socket eliminates the annoyance of



Pul Socket Current Tap.



Toggle Switch.



Showing Interior View of Single Pole Switch.

a long cord running from side wall outlet. Current can be supplied directly beneath the fixture to operate the various table electrical appliances now in general use without the necessity of sacrificing the use of the light.

The same company are also placing on the market an important addition to their line, namely, a five-ampere toggle snap switch, surface type. This switch is illustrated herewith and also was fully described in Bulletin No. 16-2.

Reorganization of Contractors' Association Progresses Rapidly in United States

As was predicted at the recent annual convention of the Electrical Contractors' Association at New Orleans, the various state organizations are rapidly organizing and endorsing the new Goodwin plan of organization. In practically every case adoption of the new constitution was effected in open meeting, at which W. L. Goodwin was invited to explain the details of his plan. Seven states have already adopted the new constitution.

The Square D Company

The Detroit Fuse and Manufacturing Company, having disposed of their fuse business while continuing to manufacture their well-known "Square D" switches, have changed their name to "Square D Company." Future correspondence should, therefore, be so addressed, at Detroit, Mich.

Electrical Candidate for Board of Trade Council

The members of the Electrical Section of the Toronto Board of Trade have long cherished the idea that the importance of the electrical industry in Toronto justifies representation on the council of the Board and are this year nominating a candidate in the person of Mr. E. G. Mack. Mr. Mack is accepting the nomination entirely from a sense of duty and



Mr. E. G. Mack.

in the hope that he may, in considerable measure, change the somewhat indifferent attitude of the general representation on the Board of Trade towards the electrical industry. That he would succeed in doing so goes without saying. A man who has shown such splendid ability in the conduct of his own business, the Crouse-Hinds Company, will naturally succeed in pressing the claims of the industry as a whole.

The Electrical Section of the Board is not big enough to elect Mr. Mack alone, but if to their votes are added the votes of their friends, the thing is done. Every electrical man in Toronto, whether a member of the Board of Trade or not, is urged to use his influence that "electricity" may have a seat at the councils of the Board during 1918.

Regulation of London Cars in Air Raids

At a meeting of London County Council on October 16, Mr. G. H. Hume chairman of the Highways Committee, in answer to questions, stated that it was in compliance with an order isued in November, 1916, by the field marshal commanding the home forces that drivers and conductors had been required to continue their journeys during air raids. In view of recent experiences, however, it had been arranged that cars might be brought to a standstill, and the motormen and conductors might take cover during gun-fire in the vicinity.

The following notice to motormen and conductors, as printed in the Tramway and Railway World, was subsequently issued by Mr. A. L. C. Fell, general manager:

I am now instructed by the commissioner of police to state that in view of the recent experiences it has been decided, with the assent of the field marshal, that notwithstanding section 2 of the order made on November 2, 1916, embodied in general orders Nos. 683 (amended) and 685, cars may be brought to a standstill, and the motormen and conductors may take cover after but not before, anti-aircraft gunfire is heard in the vicinity, and after the following instructions have been carried out:

1. Should any car be on a gradient it must be driven to a section of track which is comparatively flat.

2. Cars must not be close poled.

3. Cars must not be left at intersections of crossing streets.

4. The hand-brake of the cars must be applied to the fullest extent, and the brake ratchet wheels dogged.

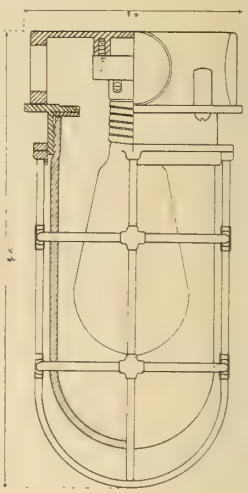
5. The controller handles must be removed if a motorman leaves his car to take advantage of the nearest cover.

Motormen and conductors should rejoin and proceed with their cars as soon as gun-firing has ceased in the vicinity.

I confidently appeal to the patriotism of all affected by this notice to make these arrangements a success. It is of the greatest importance in the national interest that the tramway services, which are essential for the transport of munition workers and the public generally, should be maintained if possible, and in any case resumed with the utmost despatch when the danger is over.

Complete Line of Marine Fixtures

The Steel City Electric Company, Pittsburgh, Pa., announce that they are now prepared to furnish a complete



line of marine fixtures. The cut herewith is typical of this line. The Canadian sales agents for this company are Hatheway & Knott.

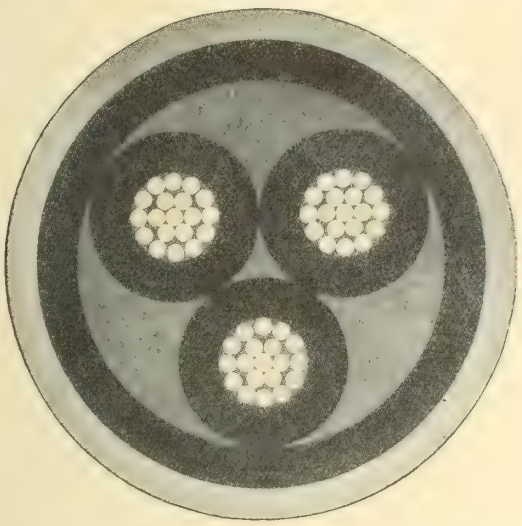
The fact that an irresponsible party rings the bell, which gives the signal to the motorman to start his car, does not relieve a railway company from liability for accident, according to a decision handed down by Mr. Justice J. M. Tellier, in an action against the Montreal Tramways Company. The plaintiff was awarded the damages claimed, together with costs of the action.

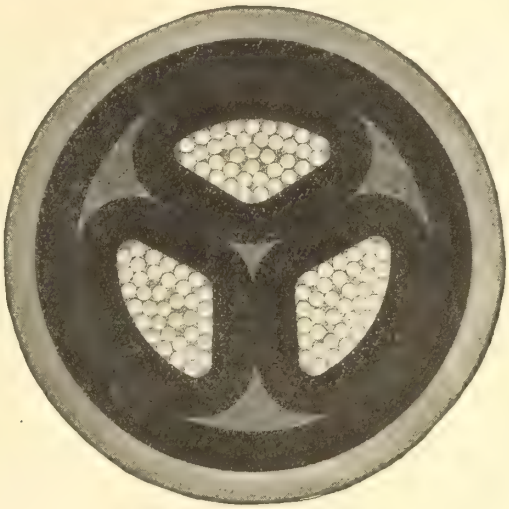
The final report of the International Joint Commission in the Lake-of-the-Woods reference has just been published in bound form, stiff linen covers. The report covers 260 pages and includes some 54 illustrations. It is the work of Lawrence J. Burpee and Whitehead Kluttz, secretaries respectively of the Canadian and the United States sections of the International Joint Commission.

The British Aluminium Company are mailing an attractive 1918 calendar, copy of which may be obtained on request to their head office, 60 Front Street West, Toronto.

PHILLIPS' CABLES

as supplied to the Toronto Hydro Electric System





These illustrations show cross sections in the original size of cables recently supplied to the T. H. E. System and reordered by them for further extensions. The specifications are as follows.—Conductors composed of 37 strands each, .082 in. diameter. Thickness of dielectric on each conductor, .210 in. Thickness in belt, .210 in. Thickness of lead sheath, .160 in. Overall diameter, 2.61 in., 250,000 C.M. Three Conductor, Paper Insulated, and plain Lead Covered Cable for 13,200 volts. We can supply you with wires and cables of any size for Power, Lighting, Telephone, Telegraph, etc.

Write us for detailed information.

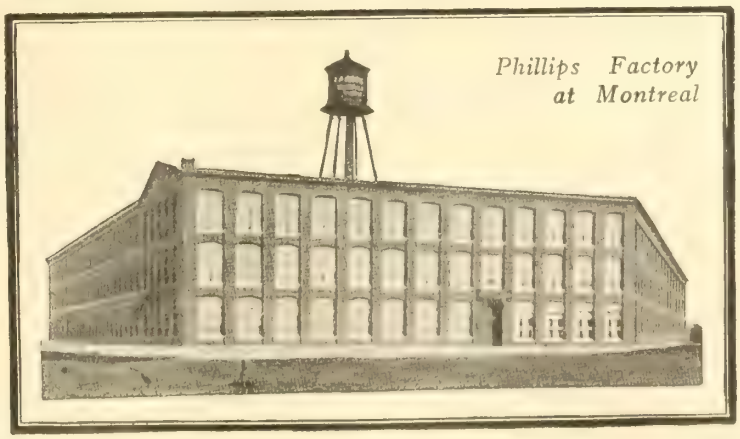
NOTE.—Specification of cable in left-hand cut: 3/0 B. and S. Three conductor. Each conductor 19 strands, each .094 in. diam. Thickness of dielectric on each conductor, .21 in. Thickness of dielectric on belt, .21 in. Thickness of lead sheath, .15 in. Overall diameter, 2.60.

Specification of cable in right-hand cut: As stated in copy.

Eugene F. Phillips Electrical Works, Ltd.

Head Office and Factory: MONTREAL

Branches: Toronto Winnipeg Regina Calgary Vancouver



Phillips Factory at Montreal

Current News and Notes

Alliston, Ont.

The town council of Alliston, Ont., contemplate electrifying the local pumping plant, and a by-law will be submitted on January 17.

Chatham, Ont.

Plans are under way for operating the Chatham-Wallaceburg division of the Chatham, Wallaceburg and Lake Erie Railway, with Hydro power. Because of the shortage of fuel the company have found it difficult to generate sufficient power for the entire system, which reaches from Erie Beach to Wallaceburg.

Forest, Ont.

A by-law will be submitted to the ratepayers of Forest, Ont., this month, authorizing the purchase of an electric fire engine.

London, Ont.

Benson & Willcox, electrical contractors, 264 Dundas Street, London, Ont., have leased premises at 266 Dundas Street and will fit up first-class electrical sales rooms.

Montreal, Que.

The directors of the Kaministiquia Power Company have declared a dividend at the rate of 8 per cent., an increase of 1 per cent. The dividends have risen from 2¼ per cent. in 1910 to that now declared.

The Montreal Tramways Company have just installed in the William Street power-house a 1,500 kw. motor-generator set. This is the last of four units ordered from the Canadian General Electric Company. Another of the units has been installed at the St. Henry sub-station and two others at the St. Denis sub-station.

Orillia, Ont.

The Light and Power Commission of Orillia, Ont., have made another reduction in rates, amounting to about twenty per cent.

Ottawa, Ont.

The Ottawa Hydro-electric Commission report that the increase in revenue for 1917 over 1916 was $38,000.

Parkhill, Ont.

The ratepayers of Parkhill, Ont., recently passed a by-law authorizing the installation of Hydro service. Work will be proceeded with in the spring.

Sault Ste. Marie, Ont.

Mr. R. T. Jeffries, of the Ontario Hydro-electric Power Commission, was recently in Sault Ste. Marie conferring with the Water and Light Commission in connection with changes in the pumping equipment.

Swift Current, Sask.

The new telephone exchange building being erected at Swift Current, Sask., is now nearing completion. An automatic system is being installed.

Toronto, Ont.

The gross receipts of the Toronto Street Railway Company for the year 1917 were $6,193,562, as compared with $5,891,505 for the year 1916.

By a majority of 36,603 the ratepayers of Toronto voted in favor of the acquisition of the Toronto Street Railway in 1921.

Unionville, Ont.

A deputation from the village of Unionville, Ont., recently waited on the Hydro-electric Power Commission of Ontario with a view to securing an extension of the hydro power system from Agincourt to Unionville.

Windsor, Ont.

The offices of the Hydro-electric Commission at Windsor, Ont., were gutted by fire recently. The loss to building and contents is placed at $85,000.

It is proposed to submit a plebiscite to the ratepayers of Windsor, Ont., in the near future, to determine whether or not public sentiment is in favor of the various municipalities interested taking over the lines and other property of the Sandwich, Windsor and Amherstburg Railway. The company's franchise expires in 1922 and they have refused to make extensions to their lines unless granted an extension of the franchise until 1932. The citizens will also vote on the advisability of extending this franchise and, as an alternative, of the city building the necessary extensions and renting them to the railway company.

Portable Nitrogen Radiator

The Willis Manufacturing Company, of Cleveland, Ohio, is offering to the trade a portable electric nitrogen radiator. It maintains an average temperature of 350 degrees Fahr. (176.7 degrees C.) it is said. The radiator contains an electric heating element, surrounded by nitrogen gas. The gas fills the entire inside of the radiator, which is hermetically sealed. The gas serves to carry the heat from the heating element to the radiating surfaces at a temperature higher than that of a steam radiator. The stock radiators are made in four, six, eight, and ten sections. Special radiators may be built in any size or type desired.

Miscellaneous

It is announced that General Electric Company profits for the year ending December 31 will total $27,000,000, a sum nearly $8,000,000 greater than in 1916.

The Crouse-Hinds Company of Canada are distributing an attractive folder showing five color illustrations calculated to demonstrate the care with which this company's various products are packed for shipment. The Crouse-Hinds "boy," of course, appears on the back cover.

An Ontario Government publication entitled "Telephone Systems, 1917," has been published, being extracts from the report of the Ontario Railway and Municipal Board for 1916 and containing statistical and other information relative to the construction and operation of telephone systems. Information is given on 666 separate, independent telephone systems.

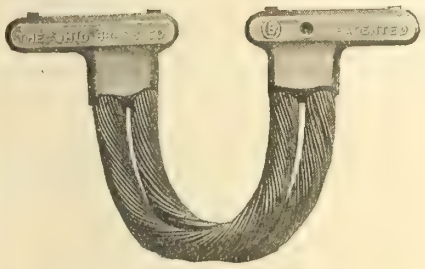
Obituary

Mr. George D. Richmond, manager of the Hamilton branch of the Bell Telephone Company, died recently. He was formerly manager at Walkerton and later at Kitchener.

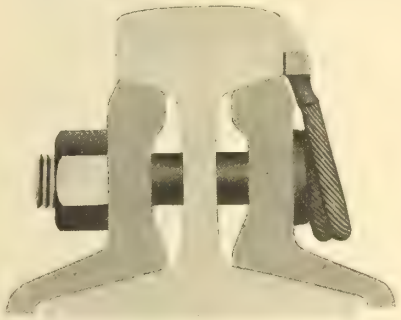
Mr. William Earle, C.E., died recently in St. John, N.B. He was at one time manager of the St. John Street Railway, although latterly was engaged in engineering work for the Dominion Government and the Canadian Pacific Railway Company.

O-B Gas-Weld Rail Bonds

For a Lasting, Low-Resistance Track Return



O-B Gas-Weld Bond
(All Copper Terminal)

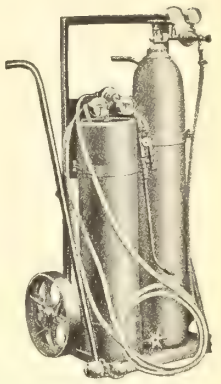


Section of O-B Gas-Weld Bond
Installed on Rail

Copper, steel and flux metal unite in a strong, permanent union when an O-B Gas-Weld Bond is put on the rail.

It is a simple process. No special skill is required on the part of the operator. If ordinary care is used every weld is a good one.

O-B Gas-Weld Bonds were pioneers. They were first installed, three years ago, on a Canadian road. Since then over 200 properties have standardized on O-B Gas-Weld Bonds. Constant repeat orders prove their worth.



Oxy-Acetylene Equipment
It may be mounted on any convenient truck.

Send for booklet.

THE OHIO BRASS CO.
MANSFIELD, OHIO

Made in Canada

Xceladuct Conduit

(GALVANIZED)

and

Orpenite Conduit

(ENAMELLED)

Orpen Conduit Co., Limited

Toronto

Electric Vehicles in Postal Service

Electric trucks are being used very successfully by the Postal Department in a large number of cities. St. Louis has had a fleet of electric trucks in its postal service for more than six years which have given splendid service even under the most severe weather conditions. These trucks are in service from 5.45 a.m. to 11.50 p.m., and average 30 miles each day.

The postal service in Boston uses 15 electric trucks, which are operated on the "battery-service" plan. These electrics make runs of 25 miles each day, and have made substantial savings as well as greater efficiency in handling the mail.

The largest electric postal fleet in this country, says the Electric Vehicle, is probably that of the New York Postal Service, which operates 47 electrics. These trucks have been in service for 3 years, and are on duty for two 10-hour periods each day. The dependable, simply operated electric truck has been found almost indispensable in this service, which requires the speedy and safe negotiation of congested traffic.

It is interesting to note, says the same source, that several foreign countries have long appreciated the electric vehicle for postal service. A fleet of 30 electric trucks was installed in Vienna in 1913, and after 1 year's experimentation were pronounced to be particularly satisfactory for the transportation of the mails. This fleet has since been increased to 45 electrics, and one truck has a record of 15 months' postal service in Austria, covering 500,000 kilometers with no interruptions for battery troubles or other repairs.

FOR SALE
IMMEDIATE DELIVERY
NEW and USED

MOTORS

No.	H.P.	Phase	Cycle	Volt	Speed	Maker
1	35	3	25	550	500	C.G.E.
1	20	3	25	550	710	Wstgh.
1	5	3	25	550	1400	T&H.
2	75	3	60	550	900	C.G.E.
1	30	3	60	550	900	C.G.E.
1	20	3	60	220	1700	Wstgh.
1	20	2	60	220	1200	C.G.E.
3	15	2	60	220	1120	Wstgh.
1	200	3	60	2200	514	C.G.E.
1	300	3	60	2200	600	Wstgh. (Synchronous).

GENERATORS

No.	K.V.A.	Phase	Cycle	Volt	Speed	Maker
2	625	3	60	2200	225	C.G.E.
1	275	3	25	6600	375	Wstgh.
1	150	3	60	2200/550	600	C.G.E.
1	100	3	60	550	900	C.G.E.
1	75	3	60	2200/550	900	Wstgh.
1	50	3	60	550	1200	C.G.E.
1	25	D.C.		125	1100	Wstgh.
2	20	D.C.		125	550	Wstgh.
1	17	D.C.		125	1100	Wstgh.
1	12½	D.C.		125	1100	Wstgh.
1	5	D.C.		125	1100	Wstgh.

TRANSFORMERS

No.	K.V.A.	Phase	Cycle	Volt	Maker
2	60	1	60	10,000/2200	C.G.E.
2	15	1	60	2200/110/220	C.G.E.
2	10	1	60	2200/110/220	C.G.E.

Write for Complete Lists

If you are in the market to buy or sell power equipment, write—

E. A. LOWRY
209 King. St. - GUELPH, ONT.

LAMPS
NITROGEN and TUNGSTEN

Write for Lowest Cash Prices

High Efficiency Lamp Co.
414 Yonge Street - TORONTO, ONT.

PETRIE'S LIST
of New and Used
MOTORS
for Immediate Delivery

No.	H.P.	Phase	Cycle	Volts	Speed	Maker
1	50	3	25	550	850	Westg.
2	50	3	25	550	750	C. G. E.
1	40	3	25	550	750	C. G. E.
1	25	3	25	2000	900	C. G. E.
1	20	3	25	550	1440	J. & M.
2	10	3	25	550	750	C. G. E.
1	7½	3	25	550	1400	Westg.
1	7½	3	25	550	720	Westg.
1	7½	3	25	550	750	C. G. E.
2	5	3	25	550	1440	Excelsior
2	4	3	25	550	1400	Excelsior
1	3	3	25	550	750	C. G. E.
1	2	3	25	550	1400	Excelsior
1	2	3	25	550	750	C. G. E.
1	1	3	25	550	1450	Excelsior

Write Us for Prices

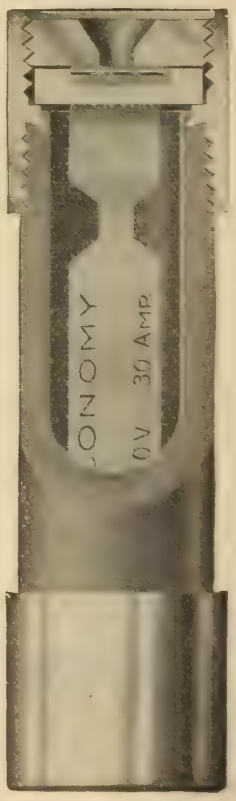
H. W. PETRIE, Limited
Front St. West - Toronto, Ont.

YOU DON'T THROW AWAY

Economy Renewable Cartridge Fuses

Simple as A B C. Just insert a new fusible element in the old cartridge and this Economy Fuse justifies its name. Good as ever. No fuss or waiting. Very inexpensive. 80% of your blow out expense saved by this method. These fuses are made in Canada and are approved by the Canadian Fire Underwriters' Association.

Write us today for catalogue 20 and sample fuse. Sent free on request.



Economy Fuse & Manufacturing Company
of Canada, Limited
UNITY BUILDING - - MONTREAL

Electrical Machinery and Repairs



Armatures Complete, Armatures Rewound, Armature Coils, Armature Shafts, Field Coils

Commutators New, Refilled or Assembled

Cleveland Armature Works

Cleveland, Ohio

3 Phase, 25 Cycle, 220 Volt MOTORS

Now Ready for Immediate Delivery

No.	H.P.	Make	Speed	Type
3	100	General Electric	550	K
1	50	Allis-Chalmers (New).	750	
1	50	General Electric	500	K
2	50	General Electric	750	K
1	50	Westinghouse .. (New)	730	CS
1	25	General Electric	750	K
2	10	General Electric	750	K
5	5	General Electric	1500	KT

Ready for Delivery in January

No.	H.P.	Make	Speed	Type
1	200	General Electric	750	K
1	150	Westinghouse	485	C
1	100	General Electric	500	K
1	100	General Electric	750	K
2	60	General Electric	750	K
3	35	General Electric	750	K
1	35	Westinghouse	1400	CCL
5	25	General Electric	750	K
3	20	General Electric	750	K
1	15	General Electric	750	K
6	10	General Electric	750	K
8	5	General Electric	1500	KT
11	3	General Electric	1500	KT
6	2	General Electric	1500	KT

JOSEPH MYERSON

274 Commercial St. - BOSTON, MASS.

DOSSERT CONNECTORS

The Superintendent of one of the largest electrical contracting firms writes us:

"The workmen have formed the habit of using Dossert Connectors for all kinds of connections and consider it a hardship if they are called upon to perform the tedious and laborious task of making a soldered joint with its attendant acid fumes, gasoline torch smoke and burned fingers."

Ask the man who makes the joint!

DOSSERT & CO., 242 West 41st St., NEW YORK

H. B. LOGAN, PRESIDENT

IRVING SMITH, Canadian Rep., Unity Bldg., MONTREAL

Selections from Our Stock of Motors

3 PHASE, 60 CYCLE MOTORS

Qu.	H.P.	Make	Volts	Type	Speed
2	½	G.E.NEW...	110	KT	1800
1	1	Fbks. M. ..	440	B	1200
1	2	Wstgh.	440	CS	1120
1	50	G.E.	220	M	900
2	3	R&M NEW.	220		1150
6	3	Wstgh. New	220	CS	1130
1	3	Cr.Wh.	220		1720
1	3	Fbks.M. ...	220	B	1200
2	2	G.E.	220	KT	900
4	3	G.E.	220	KT	1800
1	3	G.E.	220	KT	900
2	3	G.E.	220	KT	1200
2	5	G.E.NEW. .	220	KT.	1800
3	5	Wstgh. New	220	CS	1130
4	5	G.E.NEW. .	220	KT	1200
2	5	Wstgh.	220	CCL	850
30	7	G.E.	550		1200
1	7½-15	Cr.Wh..	220/440		865/1735
5	7½	G.E.NEW. .	220	KT	1800
4	7½	G.E.NEW. .	220	KT	1200
6	7½	G.E.	550	KT	1800
2	7½	G.E.NEW. .	220	KT	900
2	10	G.E.NEW .	220	KT	1800
1	10	Wstgh.	220	CCL	1700
1	10	Wstgh.	220	CS	1150
1	10	Cr.Wh. . ..	550	Q	1800
3	15	R&M	220		1150
4	15	Fbks.M.	220/440	KBV	1200
1	20	Cr.Wh..	220/440		1200
1	20	Triumph	220/440		900
2	20	Wstgh. . .	220	CS	1160
1	20	Fbks.M. . .	220	B	1200
50	20	Fbks.M	220/440	KBV	1200
29	25	Wagner.	220/440	BP	1120
1	25	G.E.	220	M	900
2	30	WagnerNEW	220		850
1	35	Triumph	220/440		900
1	35	G.E.	220	KT	600
1	35	G.E.	220	KT	720
1	40	Wagner NEW.	220/440	BP	850
1	40	Fbks.M. . .	220		900
1	40	G.E.NEW .	220	KT	1200
1	50	Triumph . .	220		720
1	50	G.E.NEW. .	220	KT	900
2	50	G.E.NEW .	440	KT	900
1	50	G.E.NEW..	220	KT	1200
2	75	G.E.NEW	220/440	K	900
1	125	G.E.	2200	L	600
1	150	Wstgh. New	440	CW	695
1	200	Wstgh. . .	2200	CCL	580
1	263	G.E. Synch. with direct connected exciter.....	2200		650

3 PHASE, 25 CYCLE MOTORS

Qu.	H.P.	Make	Volts	Type	Speed
1	5	G.E. . . .	220	KT	750
1	12½	G.E.elev.type-high torque	220	KTE	750
1	15	Wstgh. . .	440	CS	730
6	15	Allis-Ch. ..	220		750
1	15	Fbks.M. . .	440	B	750
7	20	Allis-Ch. ..	220		750
2	20	G.E.	440	K	750
6	25	G.E.	440	K	750
1	50	Allis-Ch. intermittent duty, sl. rg. drum controller	440		500
1	55	Wstgh.sl.rg. 30 cycles, complete. .	440		860
1	60 45 30	G.E.	440		500 375 250

GEORGE SACHSENMAIER & CO.

Office and Salesrooms: 141-43-45 N. Third Street.
Warehouses: 928-30-32 N. Third Street,

PHILADELPHIA

We Offer For Sale

the following

SECOND HAND 60 CYCLE MOTORS

1—30 H.P., 850 R.P.M., 220 V., 2 Phase C.G.E.
1—20 H.P., 850 R.P.M., 220 V., 2 Phase Westinghouse, CCL
3—10 H.P., 1120 R.P.M., 220 V., 2 Phase Westinghouse, CCL
2— 5 H.P., 1120 R.P.M., 220 V., 2 Phase Westinghouse, CCL
2— 5 H.P., 1720 R.P.M., 220 V., 2 Phase Westinghouse, CCL
1— 2 H.P., 1720 R.P.M., 220 V., 2 Phase Westinghouse, CCL
1— 2 H.P., 1720 R.P.M., any volt, 2 or 3 phase, Crocker Wheeler, to be wound.
3— 1 H.P., 1720 R.P.M., any volt, 2 or 3 phase, Westinghouse CCL, to be wound.
2—10 H.P., 1120 R.P.M., any volt, 3 phase, Westinghouse CCL, with Star Delta Switch.
1—20 H.P., 850 R.P.M., 220 V., 3 Phase Westinghouse, CCL
2—10 H.P., 1120 R.P.M., 220 V., 3 Phase Westinghouse, CCL
1— 5 H.P., 1120 R.P.M., 220 V., 3 Phase Westinghouse, CCL
1— 5 H.P., 1720 R.P.M., 220 V., 3 Phase Westinghouse CCL, rewound.
1— 3 H.P., 1720 R.P.M., 220 V., 3 Phase Westinghouse C, rewound.
1— 5 H.P., 1720 R.P.M., 220 V., 3 Phase Westinghouse, C

25 CYCLE MOTORS

1—50 H.P., 750 R.P.M., 550 V., 3 Phase, Can. Gen, Elec, Form K,
1—60 H.P., 750 R.P.M., 550 V., 3 Phase, Crocker Wheeler.
1—3½ K.W. Motor Generator, Westg., 110 V., D.C., 220 V., 3 Phase, 25 Cycles.

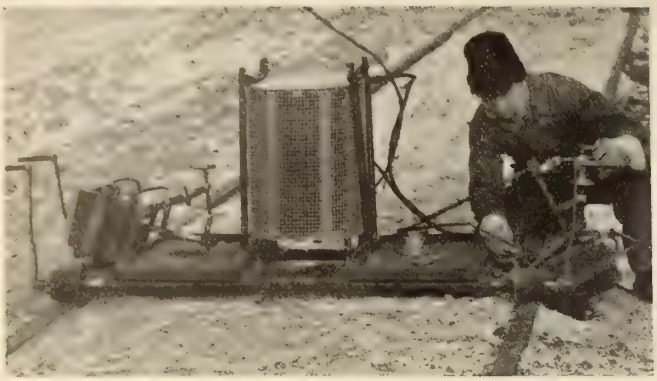
TRANSFORMERS

2—75 K.W., CGE, H.G., 60 cycles, voltage 1040/2080-115/230.
1—40 K.W., Packard R60, 60 cycles, voltage 2200-220,
1—40 K.W., Westg. C., 60 cycles, voltage 2200/1100-220/110.
1—2½ K.W., Packard R10, 60 cycles, voltage 1100/2200-110/220.

Write for prices on these or new machinery.

Toronto & Hamilton Electric Co.

99-103 McNab N., HAMILTON Limited



Portable Welder

The Portable Welder is a new device for installing the time tested

ERICO WELDED BONDS

It can be easily lifted from the track by two men. There are no rotating parts and no flame or arc strikes bond or rail.

Write for particulars

The Electric Railway Improvement Company
CLEVELAND

Friends of the Electrician

"ANTI-SULPHURIC" ENAMEL
The only reliable protection against the action of acid and chemical fumes.

"FERRODOR"
Rustproof elastic paint. Superior to Graphite or Red Lead. Defies all climatic conditions.

"DRIOROL"
Oil-proof Enamel. Dries quickly over greasy and oily surfaces. Not affected by lubricating or transformer oils.

"ARMOUR"
Fire-resisting paint, or colorless solution.

"ARMACELL"
Possesses the highest insulating qualities of any varnish on the market.

"OHMALINE"
Black, quick air-drying insulating composition. Also supplied for stoving, and as a solid insulating compound.

"SHAYDOLITE"
for coloring electric lamps. Used in the Royal Navy. Weatherproof. Dries rapidly.

"ARMABRON"
Bitumen protective paint, elastic, acid-resisting, weatherproof.

Made in London, England, by
GRIFFITHS BROS. & COMPANY
(Contractors to H. M. Imperial and Overseas Governments)
STOCKED BY
SPIELMANN AGENCIES, (Regd.)
Dealers in Electrical Specialties
Read Bldg., St. Alexander St. MONTREAL

NOTICE

Pursuant to Power Commission Act, 6 Geo. V, Chapter 19, Section 39, 1916, and amendments thereto, and the Rules and Regulations of the Hydro-Electric Power Commission covering the design and construction of electrical machinery, apparatus, appliances, devices, material and equipment for use in the generation, transmission, distribution or use of electric power or energy in the Province of Ontario, in connection with any electrical installation or wiring for electric light, heat or power, where the electric pressure delivered to or from the same exceeds 10 volts, manufacturers of, jobbers, agents and dealers in electrical machinery, apparatus, appliances, devices, material and equipment, and others interested are hereby notified that the Commission orders that on and after three months from date of this notice no such electrical machinery, apparatus, appliances, devices, material or equipment used, or to be used, as above, may be used or disposed of in the Province of Ontario unless and until the design and construction of same has been submitted to the Hydro-Electric Power Commission of Ontario, and approval of such has formally been obtained.

By order,

The Hydro-Electric Power Commission of Ontario

Dated at Toronto, December 26th, 1917.

W. W. POPE, Secretary

RAILWAY & POWER ENGINEERING CORPORATION, LIMITED

Canadian Pacific Railway Bldg., TORONTO

Long Distance Telephone Ad. 2675

Equipment and Supplies for Railway, Light, Power, Mine and Industrial Plants

"USED EQUIPMENT DEPARTMENT"

WE HAVE FOR SALE. Let us quote you on the following Equipment:

Motors—3 phase, 25 cycle

No.	H.P.	Make.	Type.	Volt.	R.P.M.
1	150	West.	Ind.	2200	480
1	100	Wagner	Ind.	2200	720
1	50	G.E.	Slip R.	2080	740
1	25	G.E.	Ind.	2000	900
1	200	West.	Ind.	550	500
1	50	West.	Ind.	550	850
1	50	West.	Ind.	550	720
1	35	G.E.	Ind.	550	500
1	6½	Lanc.	Ind.	550	1400
1	250	West.	Slip R.	400	375
2	450	West.	Ind.	400	360
3	200	West.	Ind.	440	500
1	225	West.	Slip R.	440	500
2	200	G.E.	Ind.	440	480
1	225	G.E.	Ind.	440	500
1	100	A.C.	Slip R.	440	725
3	175	West.	Ind.	220/440	500
1	75	A.C.	Ind.	440	720

We have any number of smaller sizes.

Motors—3 phase, 60 cycle

1	450	C.G.E.	Syn.	2300
1	150	C.C.W.	Slip R.	2200
1	135	G.E.	Syn.	2300
1	125	A.C.	Slip R.	2080
1	150	West.	Slip R.	550
1	150	G.E.	Ind.	550
1	150	G.E.	Slip R.	550
1	125	G.E.	Ind.	550
9	100	G.E.	Ind.	550
5	100	G.E.	Slip R.	550
2	75	G.E.	Ind.	550
3	75	C.C.W.	Ind.	550
7	50	G.E.	Ind.	550
2	100	G.E.	Slip R.	220/440
1	100	West.	Slip R.	440
1	100	Wagner	Slip R.	220

We have any number of smaller sizes.

Motors—S. Phase, 25 and 60 cycle

in all sizes, from 1/10 to 5 h.p., 110, 220 or 110/220 volt.

Motors, D.C.

in all sizes, for 110, 220, or 500 volt service.

Alternators, Belt-Driven

2—630 k.v.a., 3 ph., 60 cycle, 2,300 volt, G.E., complete, but without exciter.
1—250 k.v.a., 3 ph., 60 cycle, 2,300 volt, G.E., complete, with belt-driven exciter.
1—100 k.v.a., 3 ph., 60 cycle, 600 volt, G.E., complete with exciter.
1—50 k.v.a., 3 ph., 60 cycle, 600 volt, G.E., complete with exciter.
1—75 k.v.a., 3 ph., 60 cycle, 2,300 volt, G.E., complete with exciter and switchboard.

We also have a number of 25 cycle alternators, varying in capacity from 30 to 500 k.v.a.

Motor-Generator Sets

25 or 60 cycle, varying in capacity from ¾ to 750 kw.

Generators—Engine Direct Connected Sets

D.C. or A.C., 25 or 60 cycle, varying in capacity from 15 to 1,000 kw., of all makes, types and voltages.

Rotary Convertors

25 or 60 cycle, varying in capacity from 200 to 2,000 kw.

Switchboard—A.C. or D.C.

complete with instruments and switches.

Transformers

3—333 k.v.a. S. Ph., 25 cycle, G.E.O.C., 13,200/11,000—19,100 V. Prim.—2,300 Sec.
3—300 k.v.a., S. Ph., 25 cycle, West. O.I.W.C. 12,000/10,500 Prim., 200/140/100/70/50 sec. O. I.W.C.
3—150 k.v.a., S. Ph., 25 cycle, G.E.O.C., 11,000 Prim., 2,200 Sec.
2—100 k.v.a., S. Ph., 25 cycle, West. O.C., 2,200 Prim., 110/220 Sec..
3—50 k.v.a., S. Ph., 25 cycle, Kuhlman O.C.. 19,200/33,000 V. Prim., 2,300 Sec.
3—75 k.v.a., S. Ph., 25 cycle, Burke O.C., 6,600/2,200 Prim., 368 Sec.
3—670 k.v.a., S. Ph., 60 cycle, West. O.I.W.C., 2,300 Prim., 105/90/70/60 Sec.
4—600 k.v.a., S. Ph., 60 cycle, G. E. O. C., 12,000 Prim., 2,200 Sec.
3—300 k.v.a., S. Ph., 60 cycle, A. C. O. I. W. C., 23,000 Prim., 2,300 Sec.
3—300 k.v.a., S. Ph., 60 cycle, P. T. O. C., 2,200 Prim., 110/220 Sec.
2—200 k.v.a., ditto.
2—150 k.v.a., ditto.
3—50 k.v.a., S. Ph., 60 cycle, A. C. O. C., 2,200 Prim., 220/440 Sec.
3—25 k.v.a., S. Ph., 60 cycle, A. C. O. C., 13,000 Prim., 220 Sec.

We also have a number of smaller sizes Transformers, 25 and 60 cycles, in most all voltages.

Miscellaneous

Any number of Back Geared Motors, for 3 ph., 60 cycle, 220 volt.
Two Battery Charging Motor Generator Sets.
Five Electric Drills for 110 V. D. C.
Ten Motor-driven Blowers, 110 V. D. C.
Five Ventilating Fans for 110/220 V. D. C.
One 50 h.p. Foss Gas Engine, speed 200, one cylinder with drive wheel 4 ft. x 12 in.; used only three weeks.
500—60 cycle, G. E. and Westinghouse Light and Power Meters, of all sizes and voltages, for immediate delivery.

A complete power plant, in first-class condition, dismantled, crated, and ready for immediate shipment, consisting of:
1—Alternator, C.G.E., 60 cycle, type T.T.B., class 48—600—1501, Form E, volt 2,200, amp. 158, speed 150, direct connected to a Rice & Sargent Providence Engineering Works 18 in. x 36 in. x 32 in. horizontal cross compound condensing engine, complete with condensers; Wainwright horizontal copper tube water-heater; switchboard, piping, and valves. Ask for further information.

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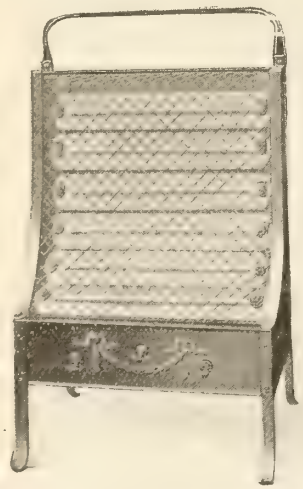


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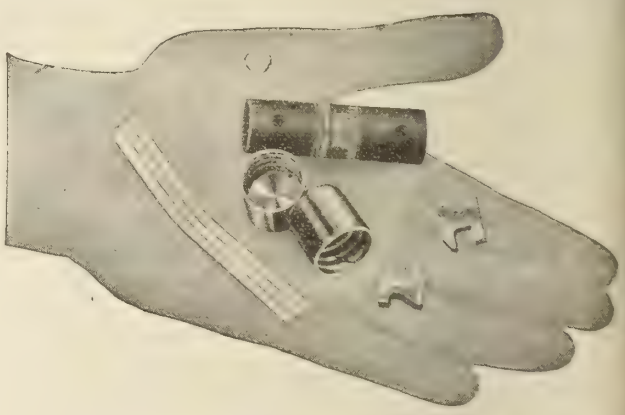
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Always were the simplest fuses in construction on the market. The new Type "B," Form 4, has been reduced to the fewest parts—four metal parts of solid brass, a fibre shell and the fuse strip. Caps are removed by a twist of the wrist and as easily tightened, holding the fuse strip in intimate metal-to-metal contact.

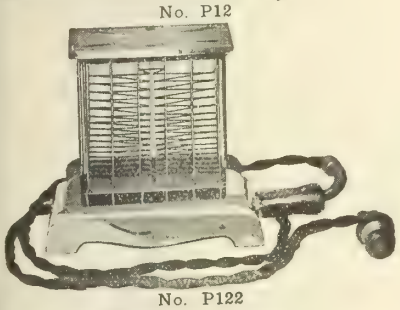
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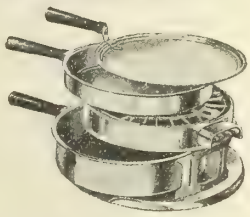




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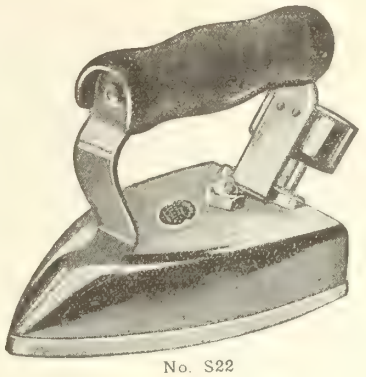
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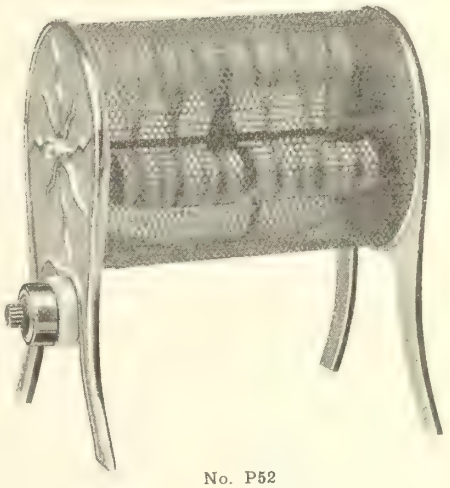
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The good reputation of Ferranti Meters is World Wide

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¶ If you have an unusual transformer problem call on us.

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They excel in
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A few dollars spent in advertising your proposals in

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would result in additional competition, which might save your city or town or your client many hundreds of dollars.

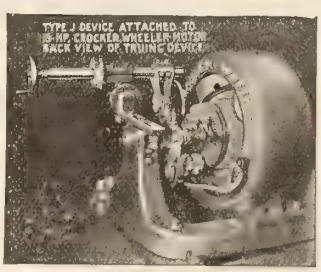
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Operates without removing armature. No shut down of motor or generator.

No large cuts from commutator and no unnecessary waste of copper.

No dragging of copper causing short circuits.

No portable slide-rest with the danger of the tool digging into the commutator and numerous other chances of damage to the commutator or armature which are all overcome with this machine.



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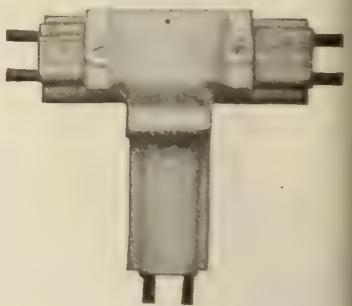
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It is not necessary to have the ends of the capping straight as the cover of the Tapon overlaps the capping, thereby covering any bad ends of capping.



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Shot—High and low carbon
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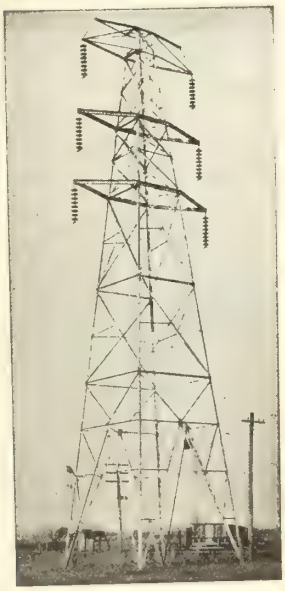
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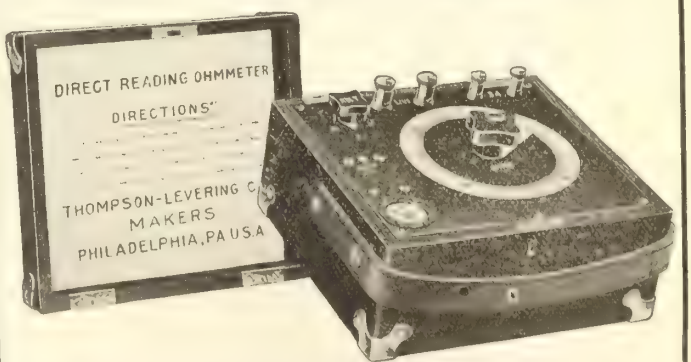
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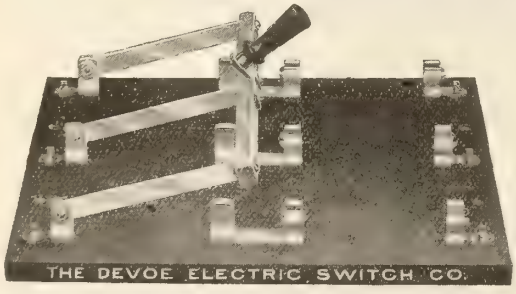
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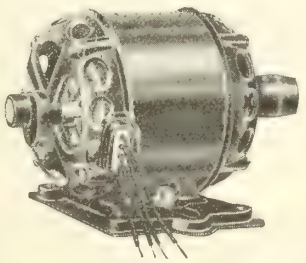
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SINGLE PHASE MOTOR



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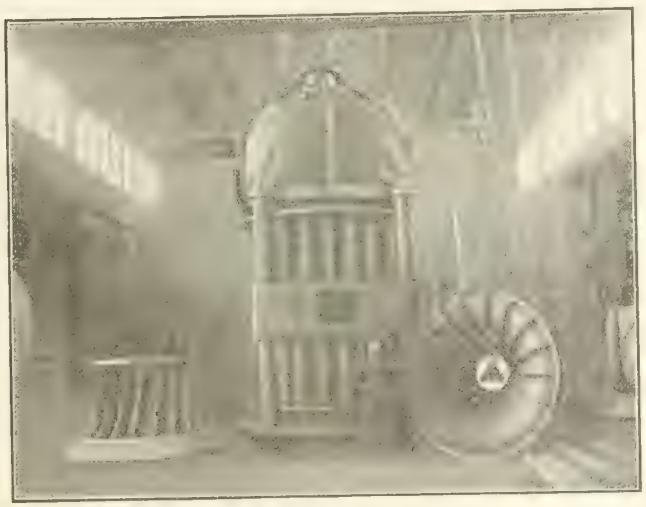
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shown in the accompanying illustration were designed and manufactured by us for the Hydro-Electric Power Commission of Ontario. They are among the largest water turbines installed in Canada and are characteristic of the high efficiency of our engineering department.

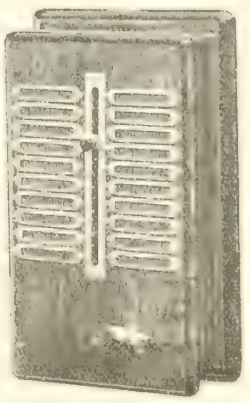
The services of these experts are at your disposal to consult on any of your engineering troubles.

BOVING HYDRAULIC & ENGINEERING CO., LIMITED

LINDSAY - ONTARIO

LOSING MEN

It is easy to lose track of a man in a plant of more than two departments. Just when you want him you cannot find him. Sometimes important matters are delayed while you are looking for the man that knows the details.



FINDING MEN

in a plant is also easy after you have installed a Presto-Call System. The Presto-Call is a Signal Service that we make in three sizes to call 5 men, 10 men or 20 men. It is easy to operate, and moderate in price; works with either vibrating or single stroke bells, or horns. The Presto-Call pays for itself in a few months.

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263 Adelaide St. West - - TORONTO

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Steel City Electric Company

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Monarch Electric Company
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Starr Son & Company, John

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Switch Safety



"Square D" Steel Enclosed Motor Starting Switches Permit Efficient Operation of Equipment

Complete enclosure of live parts protects workmen—safety lock-off feature guards against accidental closing of circuit—simplicity of design and absence of interlocking device permits inspection without interruption of service.

The present war crisis demands the adoption of every practical means to insure maximum production.

Our new catalog No. 24 contains valuable information for electrical engineers and operating electricians.

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Walkerville, Ont. 166 King St., West, Toronto, Ont.

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Couldn't make it more accurate—so we made it more flexible.

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Is now local as well as central.

A new combination lever attachment enables watchmen to close the switch by hand in daylight or night hours to locate burnt-out lamps, or to avoid outages on load controlled by the switches while clearing series troubles. The switches may be cut out of service where White Way Systems are on only on Saturday nights, special occasions, etc. If put out of step by lighting, etc., they can be stepped ahead.

This refinement broadens the scope of usefulness of the R-C-O-C equipment.

At the Power House

At the power-house, using the regular series street circuit for the control wire, the operator controls series White Way systems having combinations of all-night and short-hour lamps on the same circuit, or multiple White Way systems, having all-night or combination all-night and short-hour lamps on the same circuit; or bridge, alley, sign, pump-motor circuits; or (a most important point) pole type or subway Constant Current Transformers, controlling loops of series-circuits. Watchmen, patrolmen, time switches, and irregular lamp hours are things of the past in R-C-O-C installations.



The New 2-in-1 Case

Subway or Pole Type R-C-O-C Switches may now be obtained in the new 2-in-1 case. This is a point to be remembered where manhole space is limited, because two switches in the new case take up little more room than the single switch case, conserving space and weight on pole line installation.

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We Save You 35% Customs Duties

Electrical Storage Batteries for Country Houses, Farms, Town Lighting, Electric Trucks

Absolutely the Cheapest Storage Batteries in the Dominion

LET US QUOTE YOU

Makes Stronger Splices

Use a flux that is equal to "50-50" soder and pure copper wire—the kind that holds without starting corrosion. That's

ALLEN Non Acid Sodering Flux.

4 forms: Stick, paste, salts and liquid.

Sample for your Dealer's Name.



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ELECTRICAL CONDUCTORS

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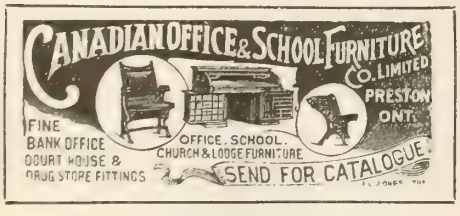
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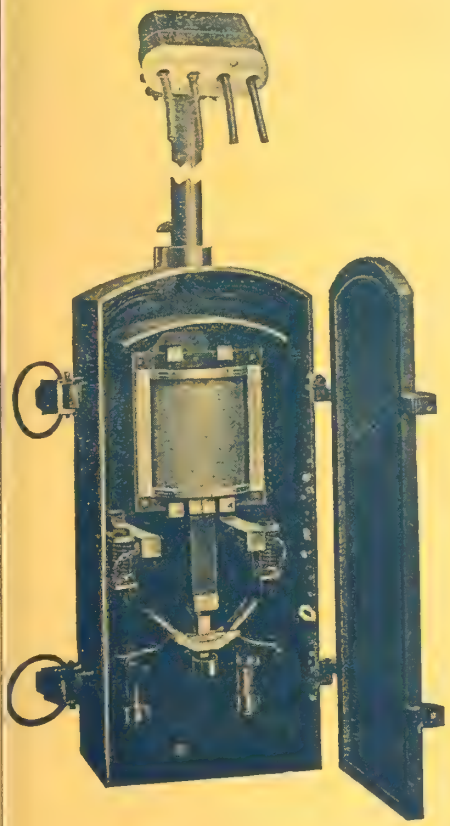
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SOLENOID SWITCHES

Essential for Modern Street Lighting Methods

This cut shows our Type 17 H.E.P. Solenoid switch which was

ADOPTED BY HYDRO ELECTRIC COMMISSION

of the Province of Ontario and used by them in a large number of Ontario towns.

Orders are received from all the Provinces.

This switch is no experiment. The fact that it has been adopted by the Hydro-Electric is proof of its success.

No springs, switch or other complicated mechanisms to give trouble. They close magnetically and are opened by gravity assisted by the tension of the laminated copper contact. All arcing is taken up on the carbons.

Increase the efficiency of your system and decrease the cost of installation by using our Type 17 H.E.P. Solenoid Switches, which are suitable for any frequency on multiple circuit or D.C. Series circuit.

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Complete Oxy-Acetylene Welding Plant

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Being Pioneers of the Oxy-Acetylene Process since its inception and with world-wide reputation and experience, and having Factories in Canada for the manufacture of Apparatus of the highest efficiency and the production of Oxygen and Dissolved Acetylene, enables us to give you an unequalled service for the necessary gases and to give you the most authoritative advice to guard you against possible disappointment in the selection of suitable apparatus.

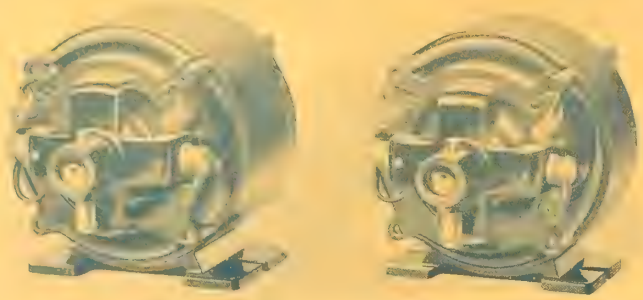
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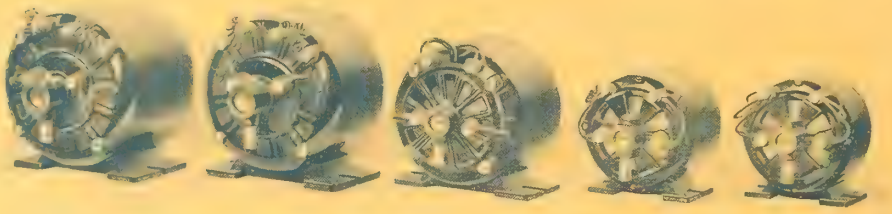
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Self-Starting Induction Motors



Continuous Service. Single Phase.
25 Cycles.

H.P.	Speed Synch. R. P. M.	Frame No.	Code	Shipping Weight
1/50	1500	A-00	Sar	25
1/30	1500	A-0	Sen	26
1/15	1500	A-1	Sul	26
1/10	1500	A-2	Tic	38
1/6	1500	A-3	Tup	45
1/3	1500	A-4	Cure	62
1/2	1500	A-4		



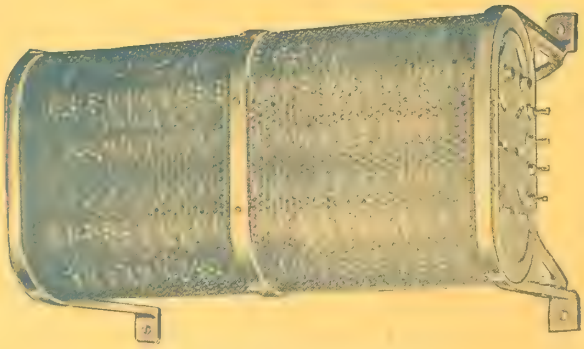
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Prices for any voltage upon request.

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Central Stations



10 K. W. Type LW Heater.

Heat your buildings on your off peak load by electricity.

Conserve more coal.

National ELECTRIC **Heaters**

are built in many sizes suitable for all requirements

Write us for further information

The National Electric Heating Co., Ltd., Toronto

Vol. XXVII No. 3 Toronto, February 1, 1918

Electrical News

Generation, Transmission and Application of Electricity



Our Facilities for Service

One of the largest and most modern factories in the Dominion.

Unexcelled shipping facilities, both by rail and water.

A complete line of high-grade electric wires, cables, and accessories, guaranteed by an experience (in the United States) of over 35 years in the exclusive manufacture and installation of such products, of which the following is an outline list:

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Rubber Insulated, Lead Covered Cables
Steel-Wire and Steel-Tape-Armored Cables
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Cable Junction Boxes
"Ozite" Insulating Compound
Miscellaneous Cable Accessories

We can generally make prompt shipments from stock of Bare Wire, Weatherproof Wire, Magnet Wire, Rubber Insulated Wire, and Cable Accessories. We are also equipped to render prompt service in supplying products usually made to order, such as Lead Covered Cables, Armored Cables, Junction Boxes, etc.

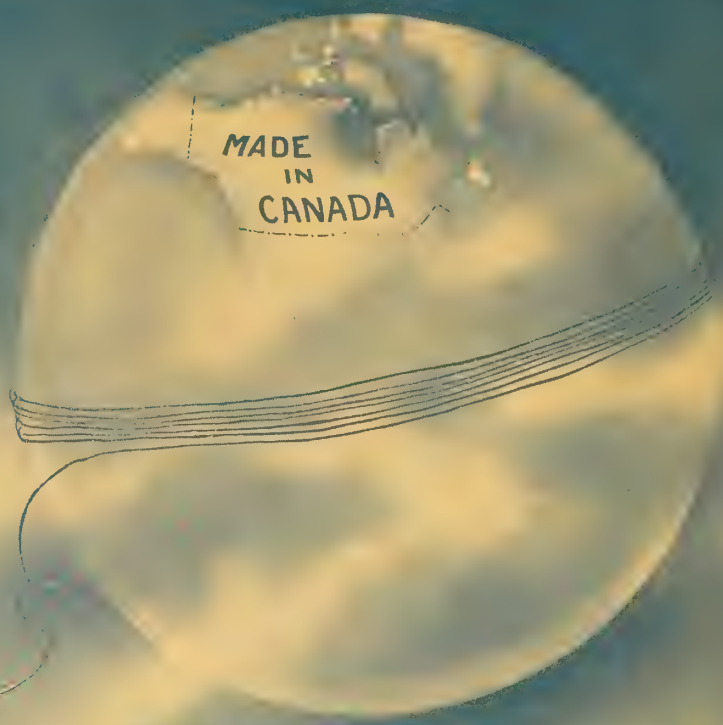
Write our nearest office for samples, estimates or prices.

Standard Underground Cable Co. of Canada, Limited

General Offices and Works: Hamilton, Ont.

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Seven Times Around the World

Over 600 miles of Lead-covered Telephone Cable was the output of our plant for one year.

The single telephone wire in this cable amounted to nearly a billion feet or enough to encircle the earth at the Equator more than seven times.

The supremacy of the Northern Electric Company as the largest makers of bare and insulated wires and cables for all purposes has never been questioned.

Northern Electric Company
LIMITED

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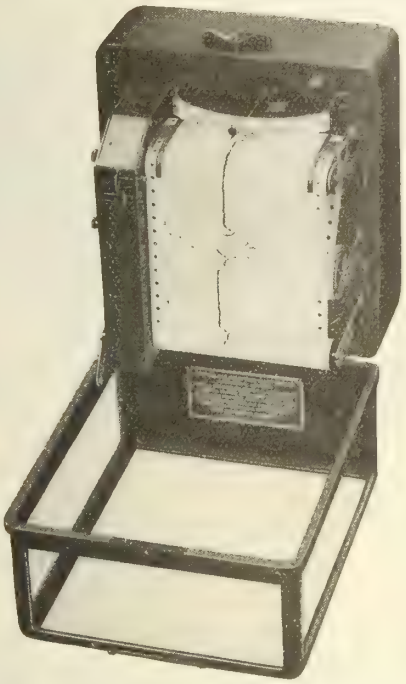


Unequalled manufacturing and shipping facilities insure prompt deliveries.

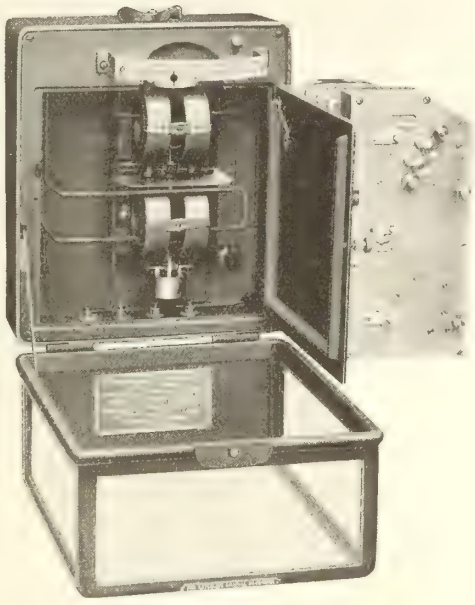


The Shipping Department is one of the largest and best equipped in Canada. It can accommodate twenty-two freight cars.

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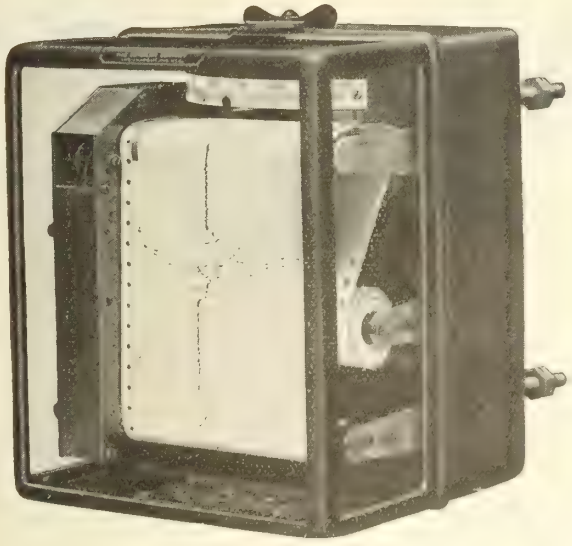
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Switchboard Type with Cover and Clock Door Open.

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THE *ESTERLINE*



Switchboard Type Wattmeter, Cover Closed.

Alternating and Direct Current.—Portable and Switchboard Types—Ammeters, Voltmeters, Wattmeters, Etc.—"The Meter with a Record."

Write our nearest house for Catalog 369.

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SHERARDUCT was used exclusively in the Physics Building, a portion of the University of Wisconsin group at Madison, Wisconsin.

SHERARDUCT

Sherardized Rigid Steel Conduit

National Metal Molding Co.

Manufacturers

Electrical Conduits and Fittings

1118 Fulton Building, Pittsburgh, Pa.

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Arthur Peabody

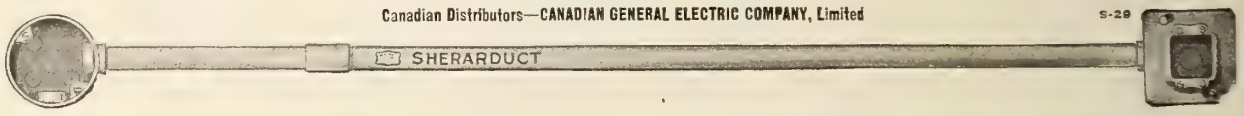
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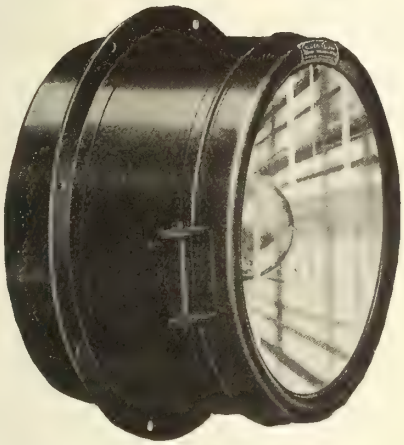
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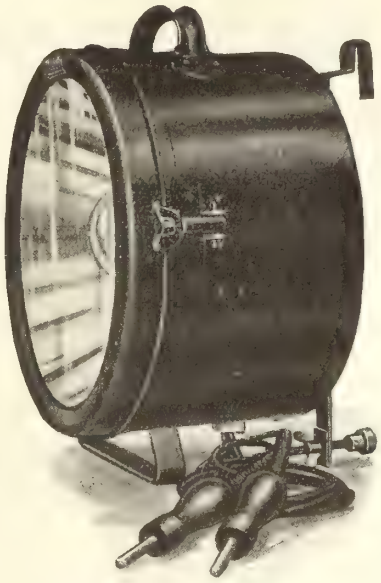
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and the

Orpen Conduit Co., Limited

Toronto

GOLDEN GLOW GOLDEN GLOW GOLDEN GLOW GOLDEN GLOW





Why You Should Use The Famous "Golden Glow" for Interurban Service

Because "Golden Glow" Headlights for interurban service project a powerful beam of non-blinding, fog-penetrating light—a volume of light which is actually greater than the average arc headlight projects.

Because they offer a wonderful saving in current consumption as compared to arc headlights.

Because "Golden Glow" light is projected in a steady, piercing beam, without flickering.

Because "Golden Glow" Headlights are scientifically correct in principle and design.

Because their reflectors are moulded from special greenish-yellow glass; ground, polished, and silvered by special machinery.

Because "Golden Glow" reflectors will not tarnish or depreciate in value; instead they retain their polished surface and efficiency indefinitely, and can be cleaned without marring their surfaces in the least.

Because "Golden Glow" Headlights will quickly pay for themselves on any railway.

Write for our new "Golden Glow" Catalog now.

Electric Service Supplies Co.
Manufacturers
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Lyman Tube & Supply Co., Ltd.
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GOLDEN GLOW GOLDEN GLOW GOLDEN GLOW GOLDEN GLOW

The famous "Drop-Out" Renewal Link can be had only in

ECONOMY renewable FUSES

This link is responsible for the saving of 80% of the annual fuse maintenance cost.

We are pioneers in the manufacture of renewable fuses. We have blazed the trail and staked our claims. The vital features of renewable fuse efficiency are protected by Economy basic patents. Imitations are by no means duplications.

Sole manufacturers of "Arkless"—the Fuse with the 100% indicator. For circuits not subject to frequent overloads this is the logical fuse. This and the Economy together meet *all* fuse requirements.

Be prepared to handle the business that our extensive consumer advertising will bring to you. Write for Catalog 20 and free samples.

Economy Fuse & Manufacturing Company

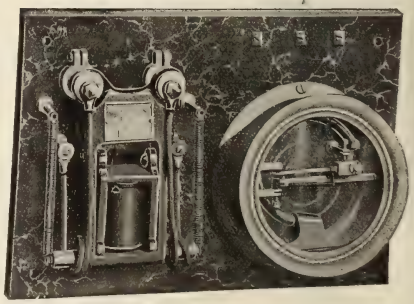
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Perfect Pressure Control

Can be obtained in tanks and reservoirs by starting and stopping the motor driven apparatus with

THE SUNDH GAUGE TYPE REGULATOR



The simplest, strongest and most satisfactory regulator made. Operates on a pressure difference of 3 to 5 per cent. of maximum pressure. Wider range may be obtained by screwing down the left-hand screw.

The construction consists of a silver-tipped contact lever attached to the tube and moving between two silver contact points on pressure fluctuations.

The screw on the right is used for adjusting to maximum pressure desired, and the lower screw on left hand is for adjusting for difference in pressure.

Send for "Sundh" catalogue giving complete description of controlling devices for A.C. & D. C.

Sundh Electric Company - - New York, U.S.A.


Quality
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STEEL and IRON
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of every
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THE "TYPE S" PORTABLE WHEATSTONE BRIDGE



Useful in the Shop and Laboratory for the Measurement of Resistance. Adapted for Fault Locations in Telegraph and Telephone Lines and Cables.

The Type S Bridge is a thoroughly practical instrument for shop and field use. Being complete in every detail it is ready at all times for immediate use. It is easily portable, its weight being but 8 pounds. The precision of adjustment of its coils (Rheostat 1/10 per cent., Ratio 1/20 per cent.) insures accurate measurements. The galvanometer, the weakest element of such an instrument, is unusually rugged. It is a separate element and may be removed for examination or repair by taking out two screws. The battery is of the ordinary "flash light" type, and renewals may be procured practically everywhere. The price is $66.25 net, f.o.b. Philadelphia, boxed for shipment.

Bulletin No. 530 describes this instrument.

THE LEEDS & NORTHRUP CO.

Electrical Measuring Instruments

4912 Stenton Ave. PHILADELPHIA, PA.

"GALVADUCT"



General view of Toronto garbage incineration plant.

A "GALVADUCT" Building.

"GALVADUCT"

The most perfect interior construction conduit on the market.

Recognized as the standard of high quality.

Always specify Galvaduct or Loricated

"LORICATED"

A high-class interior construction conduit of the enamelled type, proof against acid or other corrosive agents.

If your jobber cannot supply you—write us.

Conduits Company Limited

Toronto

"LORICATED"

CANADIAN BEAUTY

CANADIAN BEAUTY ELECTRIC HEATING APPLIANCES

All "Canadian Beauty" Appliances have been approved by the Hydro-Electric Power Commission

These are the days to plan Summer Sales



8 in. Toaster Stove

These three specials are going to be the money-makers this summer. Plan for hot weather now.

We will help you make sales. All winter our cards in the street cars of Toronto, Montreal, Winnipeg, Ottawa, London, and Quebec have carried the "Canadian Beauty" message of the comfort, convenience, and handiness of these electrical appliances. In addition to these cards, which will run all summer, our smashing big advertisements will appear in the leading magazines and papers throughout the country, to keep the goods moving and assure a quick turn-over.



New Toaster Grill

On this page we show three "Canadian Beauty" Appliances, designed and perfected by the Renfrew Electric experts. The leading Electrical Dealers, Hardware Stores, and Supply Houses —from coast to coast—have already ordered thousands of these Toasters, Grills, and Irons for March, April, and May delivery, in anticipation of the biggest summer trade they have ever enjoyed.

Our new Catalogue—showing the complete "Canadian Beauty" line — is ready. Write for a copy, and our prices on any or all of the appliances.



New 3 pound Iron

Renfrew Electric Mfg. Co., Limited

RENFREW - CANADA

REFLEX Spark Plugs



The REFLEX Line of Spark Plugs is a trade winner. They are made right—stay clean and keep the car on the go. A Gold Bond guarantee against defective material and workmanship is given with each plug.

Every customer satisfied — profits sure—a good line to handle for winning the good-will of motorists and users of engines.

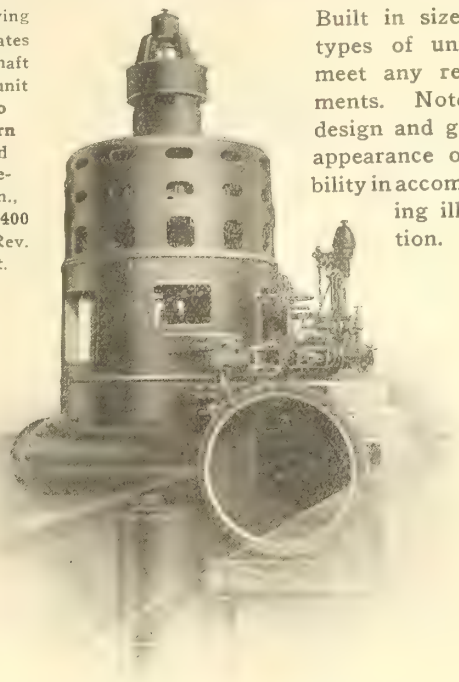
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Write for full particulars.

Great West Electric Co., Limited
61-63-65 Albert St., Winnipeg, Man.

SMITH HYDRAULIC TURBINES

Accompanying cut illustrates vertical shaft scroll case unit furnished to Northwestern Consolidated Mill, Minneapolis, Minn., developing 400 H.P., 450 Rev. under 45 ft. head.

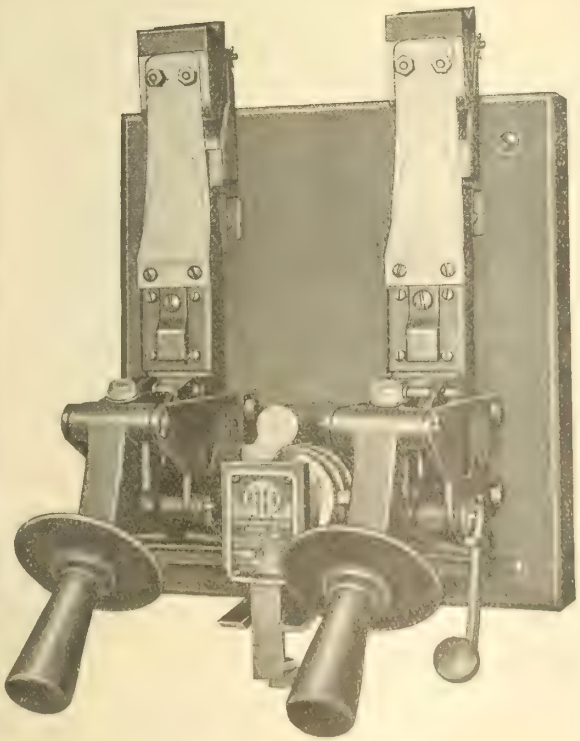


Built in sizes and types of units to meet any requirements. Note the design and general appearance of stability in accompanying illustration.

If interested in Water Power Machinery write Department "N" for Bulletin

S. Morgan Smith Co., York, Pa.
H. B. Van Every, Canadian Representative, 405 Power Bldg., Montreal

I-T-E CIRCUIT BREAKERS



Type W

Rush orders mean unexpected breakdowns unless guarded against. An ounce of CIRCUIT BREAKER PREVENTION will save a ton of trouble.

I-T-E CIRCUIT BREAKERS

pay for themselves frequently before you pay us for them. Prompt deliveries.

THE CUTTER COMPANY

Bank of Hamilton Building, Toronto

Main Office and Factory: Philadelphia, Pa.

New York, 50 Church St. Chicago, Monadnock Block.
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Indianapolis, Ind., Telephone Bldg. Minneapolis, Metropolitan Life Bldg.

ECCLES & SMITH COMPANY
Los Angeles San Francisco Portland, Ore.

Packard SERVICE is Real Service

H. I. ARMSTRONG, President and Managing-Director
JNO. E. RUSSELL, Vice-President
W. W. BARRETT, Sec'y-Treasurer

STEEL CASTINGS
ELECTRIC FURNACE
PROCESS

ALLOY STEEL WORKS, LIMITED

400 FRONT STREET EAST
TELEPHONE MAIN 6458

TORONTO, December 20th, 1917.

Packard Electric Company, Limited,
St. Catharines, Ontario.

Gentlemen;-

We desire to express our appreciation of the manner in which you handled our order for the three 100 K.V.A. transformers. This order was placed on December 3rd, and to have the transformers shipped on December 19th, taking into consideration that all the drawings and material had to be arranged for after the order was placed, is in our estimation, simply marvelous, and we can not thank you too much for the way in which our order was handled by you.

Again thanking you for your promptness in delivering these transformers and wishing you the Compliments of the Season, we beg to remain,

Yours very truly,
ALLOY STEEL WORKS, LIMITED.
PER H. I. Armstrong
Managing-Director.

HIA/m.

ALL AGREEMENTS CONTINGENT UPON STRIKES, ACCIDENTS OR OTHER CAUSES OF DELAY BEYOND OUR CONTROL
ALL PATTERNS HELD AT OWNER'S RISK

The letter reproduced is not an exceptional case. It is an evidence of our regular service that you get when you order Transformers from this Company.

Packard Transformers are built for Large Power.

Special Furnace Transformers.

Current and Potential Transformers. Welded Steel Cases.

Information, latest bulletins, estimates, etc., sent on request.

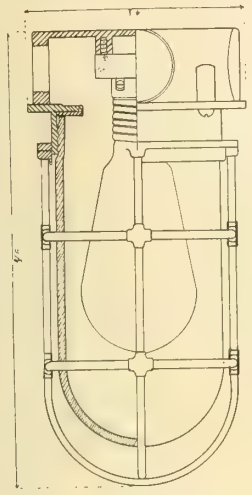
THE PACKARD ELECTRIC CO., Ltd.

ST. CATHARINES, ONT.

Bank of Hamilton Bldg., Toronto

Donalda Block, Winnipeg

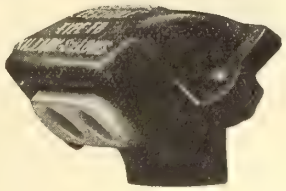
BULK HEAD FIXTURE



The above cut shows one of the many styles of Marine Fixtures we are prepared to furnish.

STEEL CITY ELECTRIC CO., Pittsburgh, Pa.

APPROVED SERVICE FITTING



Cat. No. FB712

Replaces Types B, BE, F, and FE.

TYPE "FB" ENTRANCE FITTINGS

These fittings have reversible hubs, permitting installation either as type "F" fittings on vertical pipe, or type "B" fittings on horizontal pipe.

The same parts are used for ½ in., ¾ in., and 1 in. fittings, excepting hubs, there being a separate hub for each size. The covers and porcelain are interchangeable from one size fitting to another, giving a very flexible stock arrangement.

Metal parts black japan or galvanized finish. Black japan furnished unless otherwise specified.

KILLARK ELECTRIC CO., St. Louis, Mo.

Canadian Sales Agents

HATHEWAY & KNOTT, Inc.

Electrical Merchandise **120 Liberty Street, NEW YORK**

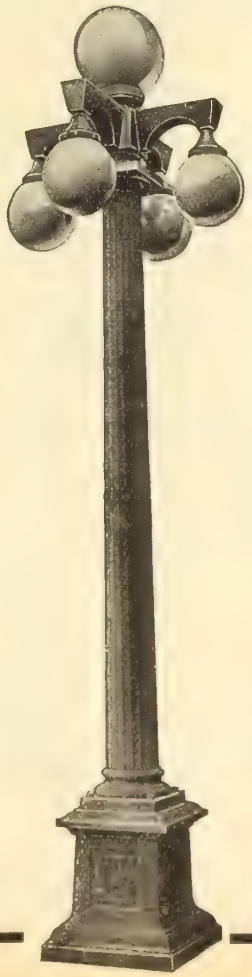
New York Headquarters for the Canadian Electrical Trade

"MOONSTONE" and "LUMO"



Ruby Ball Globes—Plain or Lettered

"Moonstone" and "Lumo" Globes *Give Satisfaction*



OUR street lighting globes, made from quality glass, used all over the Dominion. We make a specialty of lettering round and flat ball globes.

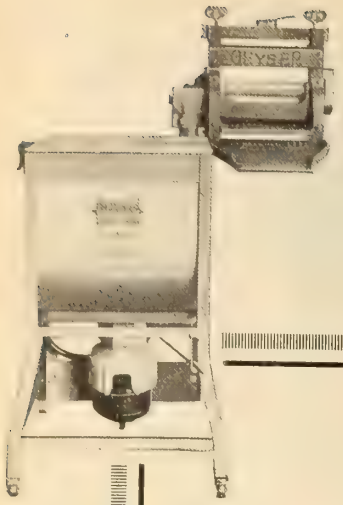
Get particulars and prices from our catalogues.

Jefferson Glass Co.

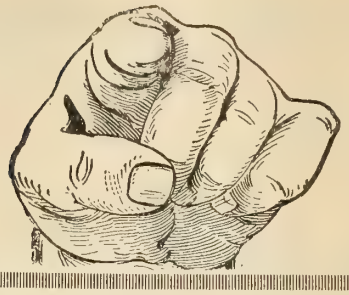
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Winnipeg—592 Notre Dame Ave., A. E. Esling, Agent.
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Swinging Wringer Type





Stationary Wringer Type

YOU

Can do it—with a GEYSER

"The World's Most Efficient Washer"

You can meet every requirement for size and style—every demand for careful, efficient clothes washing.

The "GEYSER" Principle of Washing is Correct.

A high-speed propeller in bottom of tank forces hot soapy suds through the clothes, which are contained in a constantly revolving cylinder. The entire tank and cylinder space is used. That's why the "Geyser" is simpler, lighter and more compact than any other high-grade washer. Noiseless in operation, attractive in appearance and washes clothes absolutely clean.

ABSOLUTE SAFETY—No moving parts exposed. Safety release on wringer.

EXTREME SIMPLICITY—A motor, a cylinder and two-blade propeller on shaft is the only washer mechanism.

COMPACTNESS—No waste space whatever—can be used in bathroom or kitchen.



Baby Geyser for Use in the Bathroom

NO WEAR ON CLOTHES—Because they are always entirely under hot water, and cylinder runs continuously in one direction.

QUIET IN OPERATION.

ABSOLUTE CLEANLINESS—Inside of tank and metal cylinder both treated by special plating process, making them absolutely rust-proof and easy to clean.

Three Sizes.
Swinging or stationary electric wringers.
Furnished in copper or rust-proof steel, enameled finish

A discerning, wide-awake dealer wanted in your territory. Why not you? Write today!

Secure the Agency! ***Secure the Agency!***

ONWARD MANUFACTURING COMPANY

KITCHENER, ONTARIO

Geyser Electric Washers Are Simple—Safe—Silent

G. M. Gest, Limited

Contracting Conduit Engineers

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Power Building
Montreal

Vancouver ***Winnipeg***

FERRANTI



Pole Type Transformers

Single and Three Phase

HIGH EFFICIENCY—
LOW CORE and COPPER LOSSES

Write us for Prices and Delivery before ordering elsewhere.

House Service and Power Meters, Ammeters, Voltmeters, Current and Potential Transformers supplied from stock.

Ferranti Electrical Company of Canada, Limited

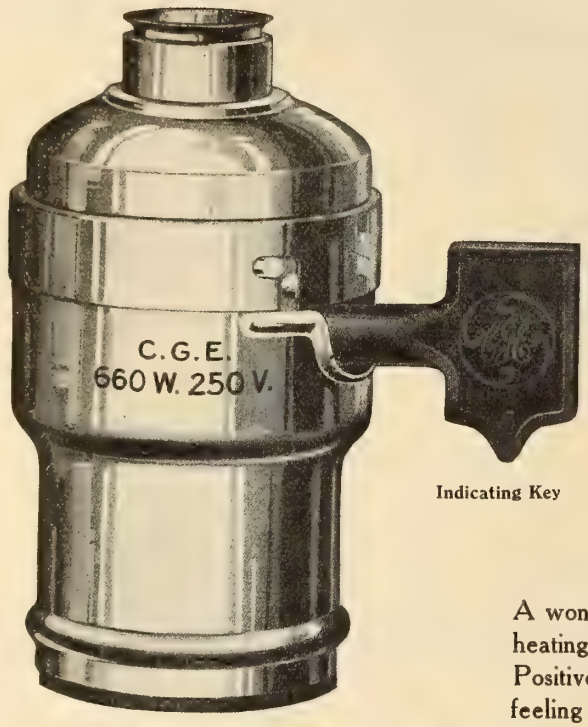
90 Sherbourne St. TORONTO | 704 Unity Bldg. MONTREAL | 592 Notre Dame WINNIPEG

FERRANTI

FERRANTI

For the Same Price

As Ordinary Sockets



Indicating Key

660 watt

Quick-Make and Break

SOCKETS

INDICATING KEY

A wonderful little help especially on heating devices—preventing accidents. Positive signal, showing at a glance or feeling that current is on or off.

1. Threaded nozzle of Socket is supplied with compressible flange which is very desirable in wiring fixtures, permitting the key of socket to be placed in any desired position and still have socket tight on the thread.
2. Indicating key tells whether current is on or off.
3. Capacity of socket permits the attachment of an iron or toaster with perfect safety.
4. Hydro Inspection Department of Ontario very shortly will not permit the installation of sockets under 660 watts rated capacity.

SPECIFY 660 WATT SOCKETS

Catalogue No. 44279—1/8" Key Socket

Catalogue No. 44280—1/8" Keyless Socket

CANADIAN GENERAL ELECTRIC CO.

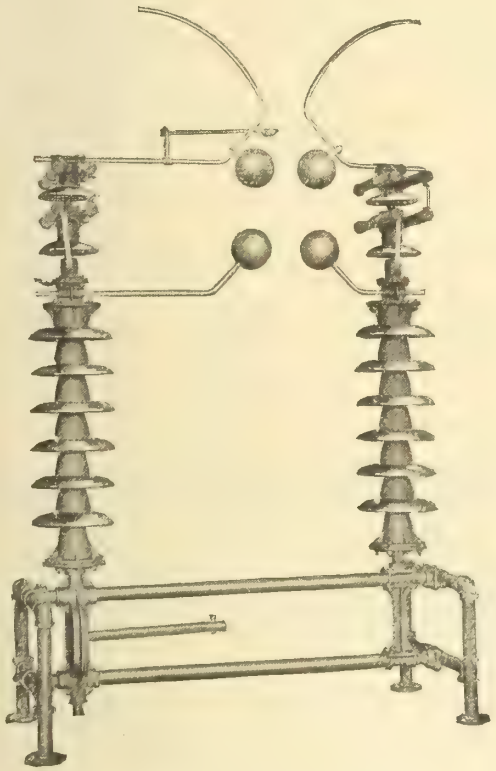
LIMITED

Head Office: Toronto. Sales Offices: Montreal, Halifax, Sydney, Ottawa, Cobalt, South Porcupine, London, Winnipeg, Calgary, Edmonton, Nelson and Vancouver.

SPHERE HORN GAPS FOR ELECTROLYTIC ARRESTERS

The use of sphere gaps with Canadian General Electric aluminum arresters is the most recent and one of the most important advances in the art of electrolytic arrester design.

All aluminum arresters are now equipped with sphere gaps, excepting those for voltages up to and including 14,000 volts. The diameter of the copper rod used for the horn gaps of the latter arresters is so large in proportion to the gap that the effect is the same as if spheres were used. It may, therefore, be considered that all arresters are provided with sphere gaps.



35,000-volt Three-phase Aluminum Arrester with Sphere Horn Gaps

The advantage of the sphere gap over the horn gap is that the former is "faster" for sudden impulses; in other words, has a shorter dielectric spark lag. A definite time is required to flash over or rupture all insulations, such as air gaps, surfaces and solid dielectrics. The time interval varies with the nature of the insulation, the shape and spacing of the surfaces or electrodes, and the frequency and magnitude of the applied voltage. Differences in the dielectric spark lag, although of infinitesimal time, are appreciable when the rate at which abnormal voltages can be applied in the case of lightning or similar disturbances is considered.

Because of this phenomenon of dielectric spark lag, a voltage in the form of a sudden impulse may not break down what is apparently the easiest path. For example, the voltage may rise beyond the discharge (60-cycle) voltage of the protective gaps, and arc over or puncture insulation having a much higher discharge test (60-cycle) voltage. It follows, therefore, that if protection against lightning disturbances of sudden impulse is to be secured, protective gaps should be as "fast" as possible and the insulation of other apparatus as "slow" as possible.

The needle gap is the slowest kind of air gap; the horn gap is considerably faster than the needle gap but the sphere gap has the greatest speed of discharge. In other words, the sphere gap has the shortest dielectric spark lag.

As shown in the accompanying illustration the upper spheres have horn extensions. The purpose of these is to assist the arc to rise and thus be quickly extinguished. This is not necessary with the lower spheres because, when the arc rises on them, it reaches the upper spheres and is thus extinguished.

CANADIAN GENERAL ELECTRIC CO.
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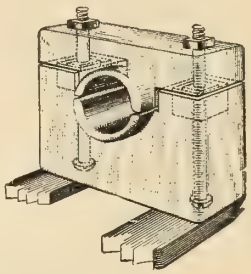
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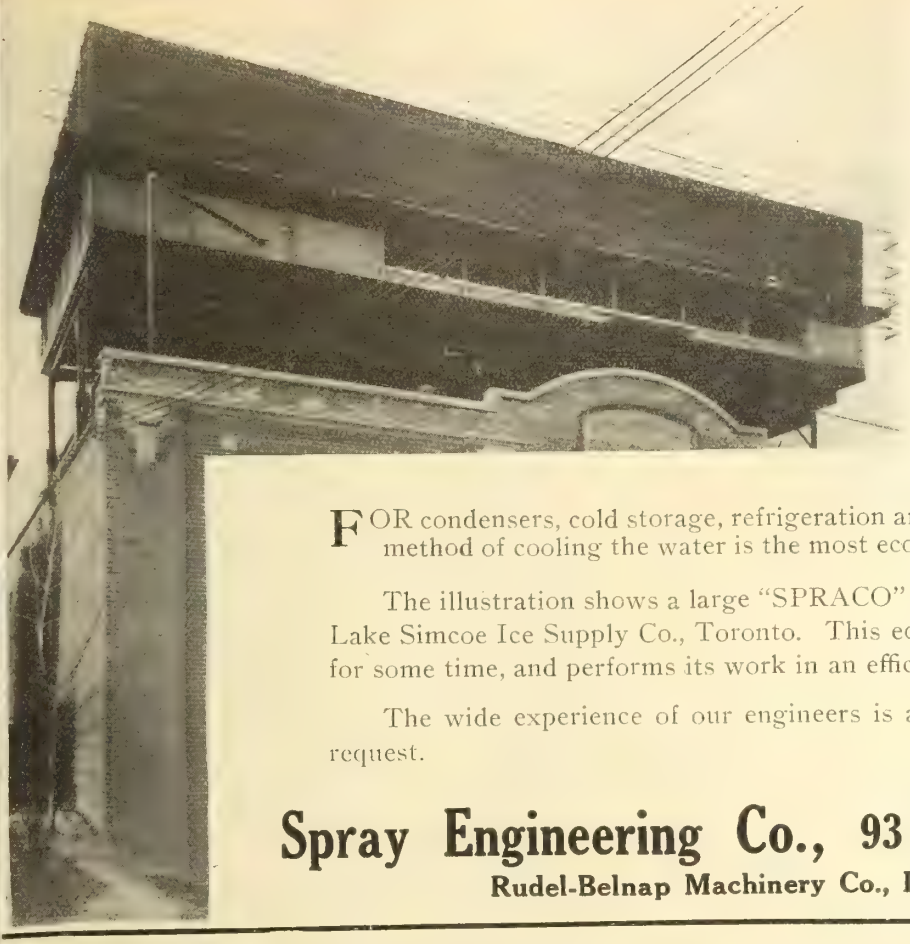
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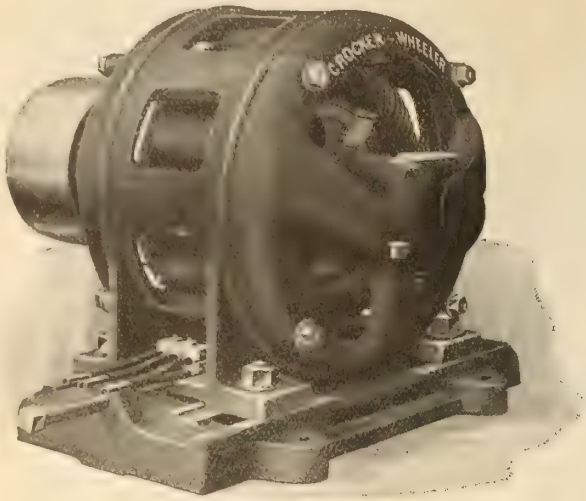
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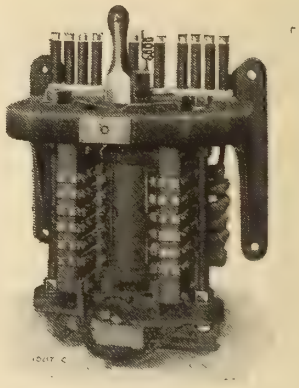
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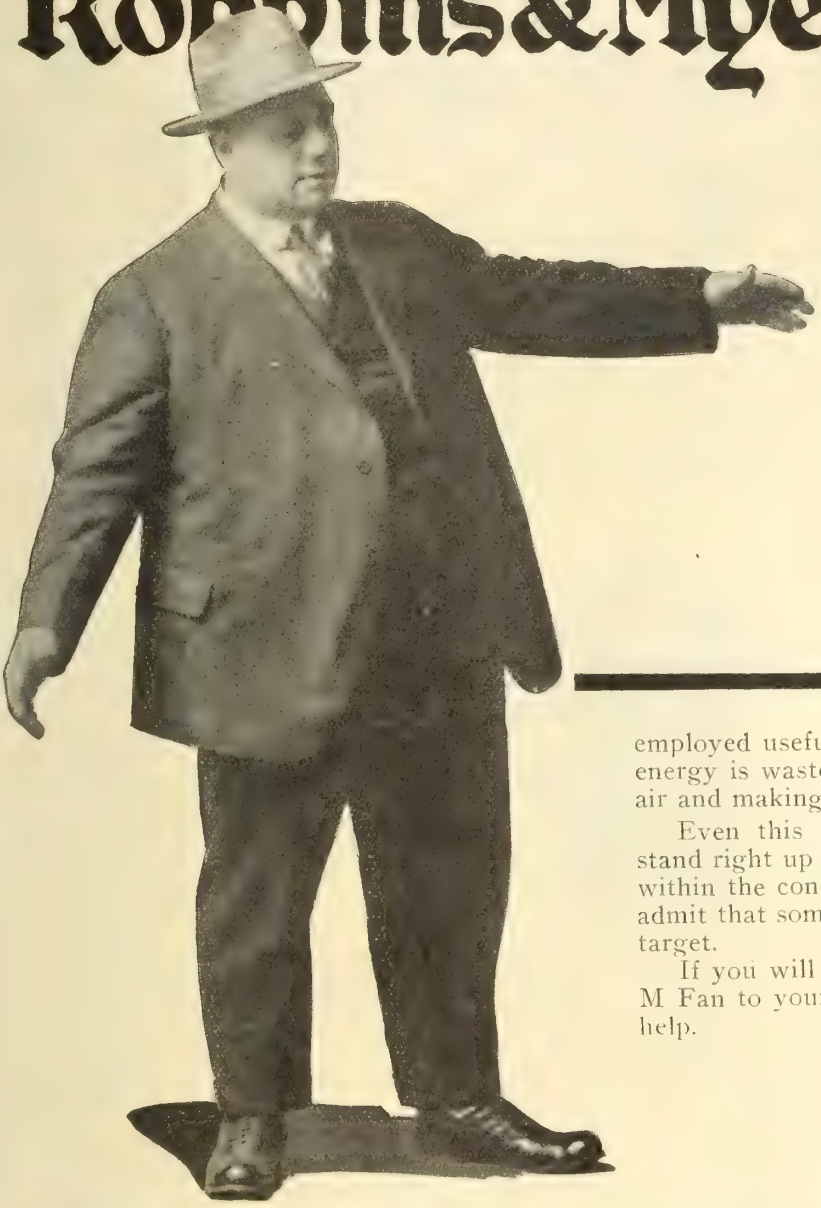
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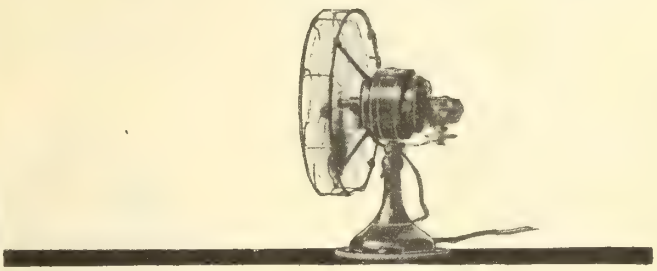
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Vol. 27 Toronto, February 1, 1918 No. 3

The Country is Waiting for "Daylight Saving" Action

When the Dominion Government convenes it is greatly to be hoped that one of the first questions they will turn their attention to is "Day-light Saving" for the coming summer. There is no disputing the attitude of the vast majority of the population towards this matter—they want the clocks set ahead during five or six months of the summer and they want the practice to be universal, for the Dominion at least, and for the continent if possible. They were decidedly disappointed that no action was taken last year.

The arguments in favor of a universal application of this principle are too well known to require repetition, and in these "shortage" days have double force. The "day-light saving" plan will materially relieve the power situation and have a very direct effect in relieving the food shortage. An extra hour devoted to food production all over the continent every afternoon could easily be made the determining factor between scarcity and plenty, not only at home, but in England and France as well.

But decision should not be left over until the last minute. Individuals and organizations alike want to make their plans in advance. The change should be in effect just as early as it is possible to make it produce any appreciable saving, certainly not later than April 1. By that date most people are losing an hour of good daylight in the mornings in bed, which may well be exchanged for an extra hour in the open air in the afternoon, added to an hour's saving of electric current at night.

There seems to be no doubt that the United States will pass such a bill at an early date to apply to the coming summer months, and Samuel Insull, president of the Chicago Edison Company, estimates that the electrical consumers of his country would be saved seven and a-half million dollars. Mr. Insull not only strongly favors the summer saving idea, but advocates the change being effective the year round, as shown by the following quotation from a recent statement:

"We estimate that daylight saving, if effective for five summer months, would save the electricity industry in Chicago about 15,000 tons of coal per annum, or for the entire country 230,000 tons of coal. It would save the electric light consumers of Chicago $365,000, and of the country about $7,500,000 per annum, this being a loss of income to the lighting companies, with coal the only offsetting saving.

"If daylight saving is made effective throughout the year, the day power load and evening lighting load will not overlap to as great an extent as at present, thus avoiding the sharp peak in load and thereby releasing plant investment for other purposes and making a further saving in coal. Otherwise it would be necessary to fire up additional boilers to cover this peak for a short time each day in the winter months.

"While I favor as a war measure the passage of the bill covering the change for summer months only, if that is all that can be put through at this time, from my experience as a utility operator I very much more strongly advocate a change in time the year round, as that means more available plant capacity throughout the country, which is quite as important as coal in the present emergency."

Power Controller's Intentions Are Not Clearly Defined

Power Controller Drayton has not exactly succeeded in clearing up the problems associated with the supply and use of electric energy. Following his first order, printed in our last issue, page 21, and dated January 8, comes a second, also dated January 8, but differing from the first in a number of essential details. Two very distinct differences are: (1) that the first order applies to "commissions, companies and persons," whereas the second applies only to "company or companies," and (2) there is no penalty clause in the first order, while there is a very considerable one in the second order—a maximum of $5,000 or five years. It is a minor detail, perhaps, that ornamental lighting is prohibited in both, which, strictly interpreted, means that the busiest streets of most of our cities and towns are to be left in total darkness.

The reason for attaching a penalty clause to the order in which "companies" only is mentioned, and omitting it in the order which refers also to "commissions" is not easy to discover. It is entirely unlikely there is any attempt at discrimination. As the matter stands, however, everybody has too vague an idea of the Controller's intentions, and it is to be hoped he will see fit to interpret them more fully, otherwise the object of the order is automatically defeated.

Steel Transmission for Short Lines is Economical

The savings which may be effected by the use of steel in the place of copper in lines of moderate length and load are described in the Electrical World in an article by L. M. Klauber. Figures of his company, San Diego Electric Company, are quoted as follows:

Steel conductors not only effect a saving due to reduced cost per unit of length, but also, owing to greater tensile strength and reliability, permit wider spacings in supports

Poles, cross-arms, insulators and line hardware have all advanced greatly in price and are often difficult to obtain at any price, and the reduction in the cost of supporting structures by the use of steel is as important as the saving in the conductor itself.

The Pacific Coast companies have for some time past used comparatively long pole spacings with copper conductors and wood-pole lines. Standard spans of 350 feet with No. 6 or No. 4 solid, or 450 feet with No. 2 or No. 1 stranded medium hard-drawn bare-copper conductors, have been used extensively without the slightest difficulty.

With the advent of steel conductors it was seen at once these spans could be greatly exceeded with absolute safety. After several branches were put in by the San Diego Consolidated Gas & Electric Company, using ¼-inch stranded steel and 550-ft. spans, 700 ft. was selected as a standard, and many miles of line have been built with spans of this length. Naturally, large sags were necessary with these spans. Although flat construction had always been used in distribution circuits employing copper conductors, the old-style triangular construction, with a pole-top pin, was adopted, with steel to give greater clearance between conductors.

The use of steel conductors and long spans introduces no difficulties. With the greater strains experienced, guying at corners must receive careful consideration. As a rule stubs must be specially heavy and anchored. Anchor guys must be used in quantity; at sharp corners four and six anchors to the pole are occasionally required.

The San Diego Consolidated Gas & Electric Company has now installed in main or branch lines exceeding a mile in length 68.6 circuit miles of steel conductors of ¼-inch, 5/16-inch or ⅜-inch standard steel. In addition there are 25 miles (75 wire miles) under construction. Also there are 52.5 wire miles of ¼-inch steel in constant-current series circuits. Most of the constant-potential circuits are 11 kv., although a few are 2300 volts.

Synchronous Motors at the A.I.E.E.

The activities of the electrical engineer in common with other members of the community are at the present time directed towards economy. In this connection the synchronous motor with its ability for reducing the wattless current on the line is a live topic and Mr. M. J. McHenry is to be congratulated on his choice of a subject for his talk on Friday evening, January 18, before the Toronto Section of the A.I.E.E. The speaker very clearly presented the relative features of synchronous and induction motor plant and showed that where the consumer's rates were based on his power-factor the extra cost of the synchronous plant would frequently soon be absorbed by the reduction in power charges. Mr. P. H. Mitchell, who presided at the meeting, in commenting upon the paper, suggested that the use of synchronous plant might be encouraged by the offer of a bonus to manufacturers who were able to maintain their power-factor above a definite standard. The paper attracted an attendance of nearly sixty, and provoked quite an active discussion.

At the next meeting, on Friday, February 1, an entertaining lecture is to be anticipated from Professor A. P. Coleman, of the University of Toronto. Professor Coleman combines the activities of a traveller with the observant instinct of a scientist and the sense of humor of a man of the world. His address is therefore distinctly one to be attended.

Mr. C. R. Dooley, of the Westinghouse Company, East Pittsburgh, is scheduled to give a paper on "Technical Education in an Engineering Works," on February 15, and two weeks later Mr. R. P. Jackson, also of Pittsburgh, will address the section on the subject, "Commercial and Industrial Research."

Power Controller Issues Second Order

Following the order noted in our issue of January 1st, Power Controller Drayton has issued a second order, as follows:—

Whereas the supply of electrical energy available is insufficient to meet the requirements of users of electrical energy in the districts of Ontario served by power generated by the Niagara River;

And whereas munition plants in whose favor priorities have been declared are still unable to obtain sufficient electricity for the production of munitions that is required;

And whereas it is necessary that the use of electrical energy by users other than those carrying on munition work, or work for the allied governments, and for municipal and public utility requirements, should be restricted—

It is ordered that no company or companies producing, distributing, or selling electrical energy in the districts of Western Ontario where electrical energy developed by the waters of the Niagara River is distributed or sold, shall, on and after the fifteenth day of January, 1918, and until further order, distribute, sell, or supply electrical energy for the use of advertising purposes or ornamental lighting.

And it is further ordered that no purchaser or consumer of electrical energy in the aforesaid districts shall use such energy either for advertising purposes or ornamental lighting on and after the said date; nor use such electrical energy for lighting the interior of buildings during the hours the said buildings are not open for business, except that during said hours such lighting may be used as shall be necessary to protect the buildings.

And it is further ordered that every company, purchaser or consumer of power violating or infringing any of the provisions of this order shall be liable to a penalty not exceeding five thousand dollars ($5,000), or imprisonment for a term not exceeding five years, or to both fine and imprisonment, for every such offence, as provided by the said Order in Council. The said penalty may be recovered or enforced by summary proceedings and conviction under the proceedings of Part XV. of The Criminal Code.

Dated at Ottawa this eighth day of January, 1918.

(Signed) H. L. Drayton,
Power Controller.

Electro-Technical Report

The report of the Canadian National Committee of the International Electro-technical Commission, presented at the annual meeting of the Canadian Society of Civil Engineers, Montreal, stated:

The committee begs to report that during 1917, as in the two years previous, the Commission's activities have, of course, been considerably curtailed, though the central office in London has done all that was possible under the circumstances to keep the organization together and to forward the work.

To this end, and because of the importance of the subject, a conference on the Rating of Electrical Machinery was held in London in September, the meetings being attended by delegates from the British and United States Committees, and by Mr. A. P. Trotter, Consulting Engineer, of London, who very kindly accepted our Chairman's invitation to represent the Canadian Committee. When the work of this conference is finished, and all details settled, another great step will have been made towards world-wide electrical standardization, with all its attendant advantages. For instance, to mention just one, all tenders, whether from manufacturers of the same or different nationalities, will then be comparable on a uniform basis as to performance claims.

guarantees, etc., a condition that has not always obtained in the past, though obviously most desirable.

The Committee has to acknowledge with thanks the continued financial support of the Dominion Government, through the Department of Inland Revenue, whose assistance is much appreciated by both the Canadian members and the central office in London.

Finally, we have pleasure in reporting that Prof. Major L. W. Gill, of Kingston, our member overseas, continues to command his battery somewhere on the French front.

Montreal Electrical Luncheons

Captain R. T. MacKeen, district vocational officer, Montreal, for the Military Hospitals Commission, addressed the Montreal electrical luncheon on January 9 on vocational training work. He gave details of the vocational training and vocational re-education of returned soldiers as it related to the Montreal district, and which is being carried on throughout all military districts in Canada. The former was to occupy the men's minds during the period of recuperation, the work including weaving and woodworking. The re-educational program was framed with a view to utilize as far as possible the previous training of the men, fitting them to occupy positions where they could obtain a livelihood. The men were sent to various industrial plants, after a short term of general educational work, to learn trades, the government paying them $45 for a single man to $95 per month for a married man during the period of training. In this way many who had received injuries which prevented them from following their usual occupations were enabled to learn other trades and to secure satisfactory wages. The department of the Hospitals Commission was thus economizing our man-power and at the same time making the men independent instead of being a burden on the community.

Private J. C. Taylor, a newspaper man, formerly of Calgary and Regina, was the speaker at the Montreal electrical luncheon on January 16. Prior to Private Taylor's speech a vote of sympathy with the family of the late Mr. Charles B. Ellis, one of the original committee of the luncheons, was passed. Private Taylor, who was wounded just prior to the Vimy Ridge battle, gave a very graphic description of camp and trench life and warfare. He referred in detail to the organization for raids, the methods of bombing, and the work done in the trenches. The talk was lightened by the recital of many humorous incidents both of camp and trench. Wounded Canadian soldiers, he also stated, were splendidly treated, both in Great Britain and Canada, and his experience was that nothing was too good for wounded men.

Successful Shawinigan Financing

In a circular issued by the directors of the Shawinigan Water and Power Company, recommending the shareholders to subscribe to a new issue of two-year 6 per cent. convertible notes, some particulars of recent developments are given. Allusion is made to the construction of La Loutre dam, built by the company for the provincial government; this has involved the expenditure of about $2,000,000, which will be paid for in bonds by the provincial government. The dam will increase the capacity of the existing water-power at the low stage of the river fully 50 per cent. In order to adequately supply the territory of the company numerous extensions to its transmission system have been made, including the construction of aerial lines over the St. Lawrence at Three Rivers, additional lines between the Laurentide Power Company at Grand'Mere and the Shawinigan Company's plant at Shawinigan Falls, and the supplementing of plant in sub-stations. With regard to subsidiaries, a further contract for the supply of certain chemicals has been made with the British Government by the Canadian Electro Products Company, extensive additions have been made to the plant of the Canada Carbide Company, while the plant for the manufacture of carbon electrodes has also been enlarged.

Mr. J. E. Aldred, the president of the company, in commenting upon the position of Shawinigan in the realm of electrical enterprises, says:

"It is perhaps not too well known in Canada that the operations of the Shawinigan Company are of such paramount importance in respect to power resources that to-day the company occupies the first place in the consideration of those industrial factors which require for their successful operation the command of large units of electric energy. We have supplanted Niagara in this respect, and it is a matter not to be overlooked that, while in every other part of the country, including the Niagara district, industrial operations have been curtailed through lack of power resources, the district served by the Shawinigan Company and its allies is the only outstanding example of a district which—during war times and especially during the year 1917, when coal conditions were so bad—has had a supply of power fully adequate for all purposes.

"When this is considered, together with the fact that this district has had at its command a greater amount of power per capita than any district in the world, and that the power has been available at lower prices than elsewhere, some idea may be had of the importance of the Province of Quebec as an industrial centre, both at present and in the future."

The credit for this position was not, he added, solely due to the Shawinigan and other power companies as the Quebec Government had adopted "an enlightened policy in fostering and making possible the development of these great power plants, with results which are in marked contrast with those that have been obtained by other methods elsewhere."

No Dividends in Last Three Years

The annual banquet of the B. C. E. R. Company's Vancouver office staff was held on Friday, December 29, when some 180 members of the staff met in this social event. Mr. George Kidd, the general manager of the company, delivered the speech of the evening, in which he declared that there were three broad divisions—public, employees and investors—which comprise the present-day public utility business. He expressed the opinion that neither the public nor the employees had had anything to complain of, but it was only because the 10,000 shareholders of the company were so far away that they had not been heard from. They had received no dividends in the last three years. The company had gone through a most trying time, Mr. Kidd declared, and had done all in their power to serve both the public and their employees. He thanked the staff for their support during the year. The toast "The Company," was proposed by Mr. A. E. Chamberlain, who declared that the company had been most courteous and generous with its employees.

Mr. W. G. Murrin, assistant general manager, proposed the toast "The Staff," in which he urged a greater co-operation between staff and the management. He declared that the company was going through a most critical period, one that required most hearty co-operation between these two. Mr. J. Munro proposed the toast, "Our Boys at the Front," which are some 495 in number. Mr. C. Woodward made the reply. A musical programme was also given, with selections from Messrs. W. McClellan Moore, W. G. Murrin, W. Menzies, J. Lacey and H. Darlin[illegible]

The Electric Club of Toronto

The Electric Club of Toronto got off to a good start on Friday, January 11, when Major Massie addressed the members and described his experiences and the part he had taken in the famous Passchendaele offensive. The members were most enthusiastic in their expressions of appreciation. On January 18 the programme consisted of a discussion of the new Constitution which the Executive Committee had drafted, and the election of officers under the new requirements. The election resulted as follows: President, Frank T. Groome, sales manager Benjamin Electric Company; vice-president, H. H. Couzens, general manager Toronto Hydro-electric System; honorary secretary, E. I. Jenking, assistant to the president Canadian General Electric Company; honorary treasurer, C. C. Bothwell, Canadian manager Laco-Philips Company; committee, K. J. Dunstan, division manager Bell Telephone Company; George D. Perry, general manager Great Northwestern Telegraph Company; D. H. McDougall, manager Toronto Electric Light Company; W. R. McRae, mechanical superintendent Toronto Street Railway Company; Geo. D. Leacock, sales manager Moloney Electric Company of Canada; B. O. Salter, purchasing agent, Hydro-electric Power Commission of Ontario; W. R. Ostrom, sales manager Northern Electric Company; Walter Carr. Mr. S. L. B. Lines, president and managing director Chamberlain & Hookham Meter Company of Canada, was elected chairman for the balance of January and the month of February.

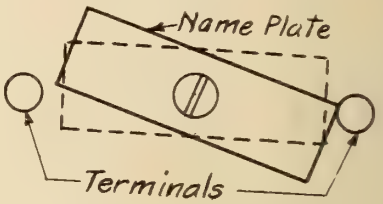
On February 1 Col. G. G. Nasmith, Ph.D., C.M.G., Director of Laboratories, Department of Public Health, Toronto, will be the speaker and on February 8 Professor Alfred Baker, professor of mathematics University of Toronto, has kindly consented to be present.

Electric Hazards in Bathrooms

The fatality reported recently in Toronto papers resulting when a woman, sitting in a bath, reached out to adjust a small electric heater, must not be taken as condemning the use of that particular heater, or any electric heater, in a bathroom, but rather as a warning that special vigilance must be exercised in the design of heating appliances and that some extra precaution is necessary when they are used in bathrooms. Nothing is to be gained by passing over the matter lightly. Indeed this is a case where it would appear to have been an actual gain if the whole of the circumstances surrounding the incident had been published widely. The impression will have gone abroad, no doubt, that heaters of the same kind as that which caused the fatality are still on the market. This, we understand, is not the case. Though heaters of this make are, of course, being sold every day we are advised that the heater in question is an old type not now being manufactured, and that the objectionable points in construction have long since been remedied. The accompanying figure explains how the accident occurred. The name-plate was held by one screw only, which had worked loose, allowing one end of the plate to fall against a terminal, thus making the frame alive.

The number of accidents in bathrooms can be reduced very materially, if not entirely eliminated, if users will take reasonable precautions. The present Underwriters' and hydro rules cover the ground pretty thoroughly as regards lighting sockets, but it is difficult to control the use of a portable equipment. It would be easily possible to prohibit the use of portables in bathrooms and require that heaters be fixed to the walls or floor at a suitable distance from the danger zone, but there is no means of enforcing such a law. It might be a step in the right direction to make such a rule, however, as the responsibility would then rest with the user. It would possibly be in the general interest if the public were cautioned through the pages of the local press or otherwise, which again might frighten certain people away from the use of them altogether. There seems to be no doubt, however, that the bathroom is the greatest danger point in the home and at any cost the public must be protected as far as it may be humanly possible.

The electrical trade and the public alike can take comfort from the recent announcement of the Ontario Hydro-



electric Commission regarding inspection of equipment. There is no law in Canada at the present time preventing the sale or purchase of unapproved appliances, but on April 1, of this year, that will be changed. After that date it will be illegal to use or dispose of any equipment that does not bear the stamp of approval of either the Underwriters' Laboratories or the Hydro Commission, and no doubt the law will be rigidly enforced. Such a law would, very possibly, have prevented the regrettable accident noted above.

Women as Street Car Conductors

Manager Fleming, of the Toronto Railway Company, does not like the idea of employing women as conductors, and is quoted as saying that "the work is too rough for them." Probably under existing conditions in Toronto this is true, but the Electric Railway Journal is emphatic in its statement that in New York women conductors are a "proved success." In a recent issue they say that the New York Railway Company deserves the thanks of the industry for demonstrating the practicability of the use of women conductors on surface cars and that some 300 women are now so employed. The article also adds: "We see no reason why women conductors should not be employed on many other roads in this country to the benefit of the women and in the interests of good service."

Evidence is not lacking during the recent months that the Toronto Railway Company is having the greatest difficulty in maintaining its former standard of service. The difficulty lies largely, no doubt, with the employees, many of the younger men having been taken for war work and replaced by men of lower standard.

It is probably now driven home to every street car patron in this city that he made a mistake when he raised such strenuous objection years ago to the inauguration of a pay-as-you-enter collection of fares. This, of course, is chiefly where the element of roughness, which in Mr. Fleming's opinion renders the work unfit for women, comes in, and we agree with him. In view of the favorable experience of New York railways it seems reasonable to expect that wherever in Canada pay-as-you-enter systems have been installed, women conductors will gradually make their appearance.

A newspaper report from Gowganda, Ont., states that efforts are being made to re-finance the South Bay Power Company and install a plant at Hanging Stone Falls, the initial development of which will be 350 h.p. The report also states that the Reeves-Dobie Mining Company are behind the proposal and will use the initial power in the working of their properties.

Transmission Line Practice—Sag and Span Problems—II.

By Lieut. E. T. Driver and E. V. Pannell, Assoc. I.E.E.

Correct determination of sag and tension in the line conductors is the most important problem in connection with the mechanical design of the line. If the sags be figured to small excessive strains will come upon the cables and towers, whilst if the wires are strung with a large sag in an attempt to reduce the tension, not only will the towers be high and costly, but the swinging together of conductors must be anticipated. The following article outlines a useful method of predetermining the sag and tension in any conductor making full allowance for span length, wind and ice loads, temperature and other conditions.

Under any conditions the sag of a wire on a span l feet in length is

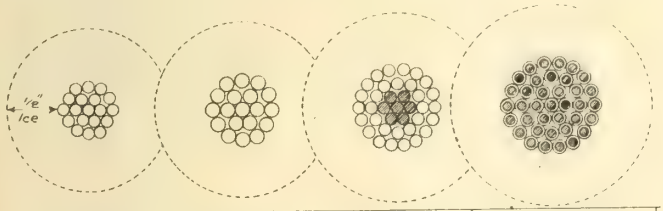
$$S = \frac{Wl^2}{8T} \quad \ldots \quad (1)$$

where W = total load per foot run;
T = tension in the wire at lowest point.
S = sag in feet at the lowest point.

If W were merely the weight of the wire this law would be a very simple one for calculating sags; as a matter of fact, however, W is the resultant of the weight of the wire and external loading due to ice and wind. The maximum external load will naturally vary according to latitude, but it will be taken in this article as equal to the Class B loading of the National Electric Light Association Joint Committee on overhead crossings. This is commonly regarded as good practice over the greater part of North America and involves the following factors:

Ice, ½ inch thick all round the cable.
Wind, 65 miles per hour or 8 lbs. per square foot on the projected surface of the cable.
Temperature, 0 deg. Fahr.

Under these conditions it is usually assumed that the



COPPER	ALUMINIUM	ALUMINIUM-STEEL	COPPER CLAD STEEL
Equivalent Size c m 211600	211600	211600	211600
Weight per foot lbs .65	322	545	1.47
" " " with ice 1.29	1.056	1.23	2.30
Wind load per foot 1.01	1.11	1.16	1.21
Total load " " 1.64	1.54	1.69	2.60
Loading factor q 2.53	4.74	3.10	1.77
Sag at 0°F. with maximum load feet			
200 foot span 1.65	2.00	1.00	1.00
400 " " 6.65	8.20	3.45	3.40
600 " " 14.9	18.3	7.80	7.70
800 " " 26.6	32.5	13.8	13.60
1000 " " 41.5	51.0	21.6	21.40
Stress lbs per sq in 30000	14,000	30,000	37500

Fig. 3—Ice and wind loading on 4/0 equivalent-conductors of different metals.

wires will be stressed to 50 per cent. of their breaking load. Some specifications use the elastic limit instead of this figure, but as the elastic limit is a somewhat indeterminate quantity it is better to assume the figure of 50 per cent. of the ultimate stress, which is somewhat lower. These are assumed to be the worst average conditions under which the line will be expected to operate, and all sag and tension calculations are based upon these. In Fig. 3 these loads are shown as applied to cables of copper, aluminium, aluminium-steel and copper-clad steel, all of which are equal in conductance to No. 4/0 B&S copper. It will be interesting to follow through a series of calculations with these four cables to ascertain their different mechanical properties.

Equation (1), although it does not give very much information, is the basis for all sag calculations. It gives directly the sag which will occur under the most severe conditions of wind and ice load (as shown in Fig. 3). The expression can be made useful by a slight modification.

As already shown, W is the total load, including weight of wire, weight of ice-coating and wind pressure per foot; the actual weight of the cable without loading per foot may be expressed by w; then for W/w we use the symbol q, or loading factor. Further, the tension denoted by T is equal

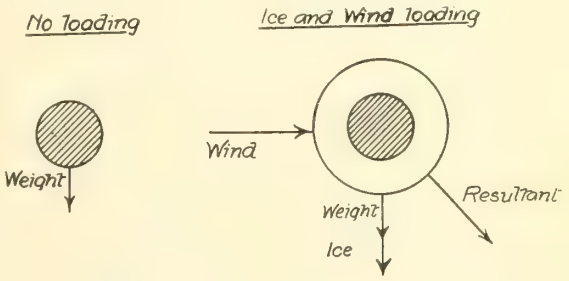


Fig. 4—Method of assuming total loading on wires.

to the stress per square inch multiplied by the area of cable. Therefore,

$$S = q \times \frac{w}{a} \times \frac{l^2}{8F}$$

where F is the stress in lbs. per square inch.

Now the quantity w/a is a constant for the material; for copper it is 3.9 and F, the maximum stress, is also taken as a constant, being 50 per cent. of the breaking load, or 30,000 lbs. per square inch. From this we get:

$S = ql^2/61500$ for copper,
$S = ql^2/93200$ for aluminium,
$S = ql^2/155000$ for aluminium-steel (7 strand),
$S = ql^2/134000$ for aluminium-steel (37 strand)
$S = ql^2/125000$ for aluminium-steel (61 strand),
$S = ql^2/82500$ for copper-clad steel (40 per cent.)

The question that now arises is "how much will the cable sag when relieved of the ice and wind load?" It is clear that the wire, being elastic, will shorten up as the load is removed, and thus reduce the sag, but a graphic method will be used to show just how much this effect amounts to. Now when the external load disappears the sag is

$$S = \frac{wl^2}{8aF}$$

or in other words, q, the loading factor, has also disappeared. Now this equation cannot be solved because there are two unknowns, the sag and the stress F. The other quantities are constant for a given span and material, so we have S = K/F and SF = K; this is the equation of a

rectangular hyperbola which can be easily plotted (Fig. 5). It is obvious that the sag we are attempting to ascertain (that of 0 deg. Fahr, without wind or ice) lies somewhere on this curve.

It is now necessary to consider another property of the wire; its strain or elastic stretch. For the present purpose this is to be considered as a contraction, for, with relief from load, the wire will shorten up. With the maximum

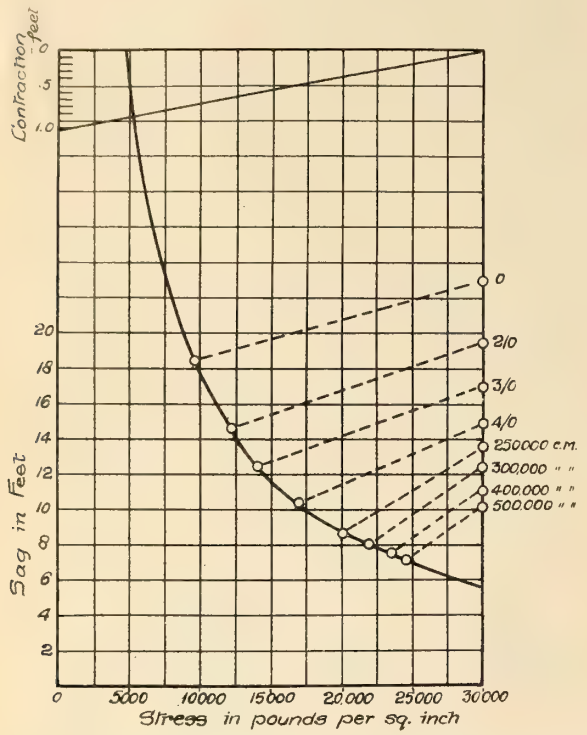


Fig. 5—Chart for calculating the sag on copper conductors when the ice and wind loading is relieved. The curves are based on the following constants: E = 16 x 10^6. Maximum stress = 30,000 lbs. per sq. in.; Ice coating = ½ in.; Wind pressure = 8 lbs. per sq. foot; Span 600 feet.

stress of 30,000 lbs. per sq. in. the value of this contraction is zero, and its maximum corresponds to zero stress in the wire, if that were possible. The value of E, the modulus of elasticity for copper, is 16 x 10^6 and the reciprocal of this (λ) .062 x 1/10^6 gives the feet extension per lb. stress per foot of span. On a 600-foot span with full stress of 30,000 lbs. this amounts to:

$$.062 \times 600 \times 30{,}000 \times 1/10^6 = 1.12 \text{ feet}$$

and this extension or contraction curve is plotted at the top of Fig. 5. The maximum sags on different sizes of cable are easily calculated from the elementary formula (1) and these all plotted on the maximum stress line (30,000 lbs.).

Now there is a very elementary law connecting the length of wire with the sag and this can be modified to give the change in sag corresponding to a change in length:

$$L_1 - L = -\frac{8}{3l}(S_1^2 - S^2) \quad \ldots \ldots \ldots \ldots \ldots \ldots \quad (2)$$

where

L_1 = total length of wire,
L = total length of wire after load is relieved,
l = length of span,
S = sag before load is relieved.
S_1 = sag after load is relieved.

($L_1 - L$) is, of course, the contraction, and this is given by the curve at the top of Fig. 5, and, taking the values from this, it is easy to solve equation (2) finding new values of sag corresponding to those of contraction. Plotting these figures it will be found that the sag decreases rapidly as the wire contracts and ultimately the sag curve cuts the hyperbola. This intercept immediately gives the required value, i.e., the actual sag of the wire when ice and wind loads are relieved.

Of course, in practice it is not difficult to find a value of sag very close to the hyperbola, and thus obtain the intercept in one operation without plotting a sag curve.

Fig. 5 is a very useful chart to have and it should be prepared for every span in general use, and for copper, and any other materials which are to be figured upon.

All the foregoing operations refer to constant temperatures, the sags already calculated being at 0 deg. F. It is now necessary to ascertain the increase sag with rising temperature. Since the wire has a definite percentage increase in length for every degree rise it follows that the sag will also increase. However, as the wire lengthens the tension will naturally diminish and the contraction we have already studied comes into play. Just what is the net effect of these two changes it is now proposed to enquire, for unless allowance be made for both of them it is impossible to calculate the true sags at the maximum summer temperature.

Suppose that $L_1 - L$ again represents a change in the length of the wire, but this time due to warming up of the surrounding air; this change is also equal to $l\alpha t$
where l = length of span,
α = per cent. increase in length per 1 deg. F.
t = rise of temperature F. deg.

(correctly L, the length of the wire, should be used in the above instead of l the span length, but the use of the latter

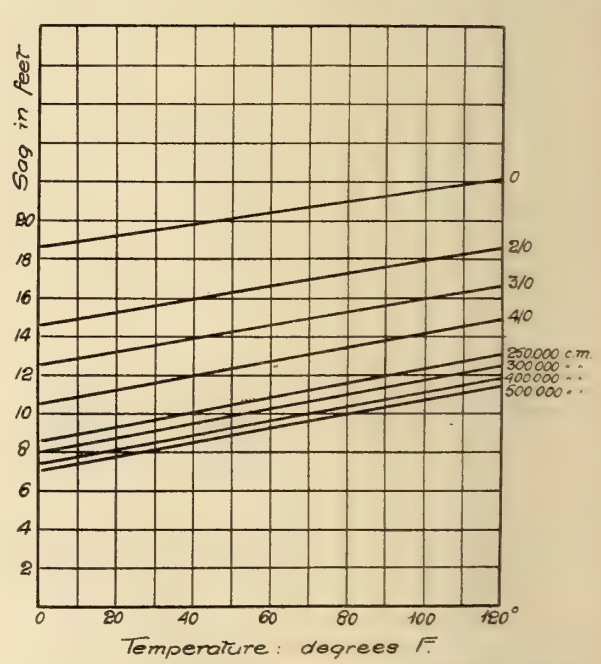


Fig. 6—Curves showing increase in sag from 0° to 120° F.; copper cables, 600 foot span. The sags at 0° F. are derived from Fig. 5.

quantity introduces only a negligible error and greatly simplifies the operation).

Now from equation (2)

$$(L_1 - L) = -\frac{8}{3l}(S_1^2 - S^2) = l\alpha t$$

so that

$$t^\circ = \frac{8\,(S_1^2 - S^2)}{3\,l^2\alpha} \quad \ldots \ldots \ldots \ldots \ldots \quad (3)$$

This relation would be quite true if the material were absolutely non-elastic, as we might imagine of some extremely

soft metal. However, as this is not the case, a simple correction must be made;

Let λ = extension per lb. stress

a = extension per 1° F

$$\text{and } \frac{a}{\lambda} = \beta$$

now when the sag changes as above from S to S_1 there is a change in stress from F to F_1 and as was shown by the curve in Fig. 5 $F_1 = \frac{FS}{S_1}$

and the temperature for any given change in sag is

$$t^\circ = \frac{8(S_1^2 - S^2)}{3\,l^2 a} + \frac{F_1 - F}{\beta} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

From this it is easy to plot out a sag-temperature curve which is found to be a straight line. Furthermore, because the product of sag and stress is constant for all temperatures a table of tensions can be prepared from the foregoing which will give the necessary dynamometer pull at the temperature of erection. In Fig. 6 a temperature-sag chart has been prepared for different sizes of copper cable on a 600-foot span, and in Fig. 7 values of sag, stress and temperature are given for different materials of conductor all for a 600-foot span. It would have been interesting to follow out this study so as to include shorter and longer spans also, but sufficient information has been given to enable this to be done.

The sizes of conductor in Fig. 7 are equivalent ones, that

Equivalent size of Cable: B & S gauge

	°Fahr	0 Sag	0 Stress	2/0 Sag	2/0 Stress	3/0 Sag	3/0 Stress	4/0 Sag	4/0 Stress	250 000 Sag	250 000 Stress	300 000 Sag	300 000 Stress	400 000 Sag	400 000 Stress	500 000 cir.mils Sag	500 000 cir.mils Stress
Copper	20	19.2	9800	16.2	11500	13.1	13500	10.5	16600	9.2	19300	8.8	20000	6.2	21500	7.8	23600
	40	20.0	8900	16.0	11000	14.0	12600	11.2	15700	10.1	17400	9.5	18600	6.8	20000	5.4	21000
	60	20.5	8600	16.6	10600	14.8	11900	12.0	14700	11.0	16000	10.3	17100	9.6	18500	9.2	19800
	80	21.0	8400	17.2	10800	15.5	11400	12.8	13800	11.8	14900	11.0	16000	10.3	17100	10.0	17600
	100	21.5	8200	18.0	9800	16.0	11000	13.6	13000	12.4	14200	11.8	14300	11.0	16000	10.8	16900
	180	22.0	8000	18.6	9400	16.6	10600	14.4	12200	13.0	13500	12.5	14100	11.8	14900	11.5	16300
Aluminium	20	9.70	2000	22.5	2400	17.5	3050	15.5	3450	12.4	4350	10.8	5000	8.2	6600	7.2	7500
	40	27.5	1960	23.0	2340	18.5	2980	16.5	3360	13.5	4000	12.0	4600	9.5	5700	8.5	6350
	60	28.0	1930	23.8	2260	19.5	2760	17.4	3100	14.5	3780	13.3	4060	10.8	5000	9.8	5500
	80	28.5	1890	24.5	2200	20.5	2630	18.4	2930	15.6	3460	14.6	3700	12.2	4400	11.0	4900
	100	29.0	1860	25.3	2130	21.5	2510	19.4	2780	16.7	3220	15.8	3420	13.4	4080	12.2	4400
	180	30.0	1800	26.1	2060	22.5	2410	20.4	2640	18.0	3000	17.0	3170	14.6	3700	13.5	4010
Aluminium-Steel	20	8.0	8750	5.8	12100	5.2	14200	4.2	17600	4.0	18500	3.6	18400	3.4	19600	3.2	20800
	40	9.0	7800	6.8	10300	6.1	12200	5.0	14800	4.7	15800	4.2	15800	4.0	16600	3.8	17500
	60	10.2	6850	7.8	9000	7.0	10600	5.8	12700	5.4	13700	4.8	13800	4.5	14800	4.4	15100
	80	11.2	6300	8.8	7950	8.0	9250	6.6	11800	6.2	11900	5.4	12300	5.1	13000	4.9	13600
	100	12.2	5750	9.8	7150	8.9	8340	7.4	10000	7.0	10600	6.0	11100	5.6	11800	5.4	12300
	120	13.3	5250	10.8	6500	9.8	7550	8.2	9000	7.7	9650	6.8	10100	6.2	10700	6.0	11100
Copper-clad Steel	20	6.5	25300	5.9	27900	5.7	28900	5.5	29900	5.4	30400	5.3	31000	5.2	31700	5.1	32300
	40	6.9	23800	6.4	25700	6.1	27000	5.9	27900	5.8	28300	5.7	28900	5.6	29400	5.5	29900
	60	7.4	22800	6.7	24500	6.5	25300	6.3	26100	6.2	26500	6.1	27000	5.9	27900	5.8	28300
	80	7.8	21000	7.3	22500	6.8	24800	6.7	24500	6.6	24900	6.4	25700	6.3	26100	6.2	26500
	100	8.3	19800	7.8	21000	7.3	23500	7.1	23100	7.0	23400	6.9	23900	6.7	24500	6.6	24900
	180	8.8	18700	8.2	20000	7.7	21400	7.6	21600	7.4	22200	7.3	22500	7.1	23100	7.0	23400

Fig. 7—Sag in feet and stress in pounds per sq. in. for different classes of cable on a 600 ft. span. Maximum loading is ½ in. ice and 8 lbs. wind at 0° F.

is, the size of copper-clad referred to as 4/0 is not actually that size, but is the one which is exactly equal to 4/0 copper in resistance. Thus all the different metals are compared on a common basis of conductance. Taking for an example the 4/0 size it will be seen that the maximum sag with aluminium-steel or copper-clad cables is about half that obtained with copper, whilst straight aluminium gives a sag 50 per cent. more than copper. These relations vary for different sizes and spans and should, of course, be worked out in each case. Copper-clad wire corresponds very closely to aluminium-steel in its sags so that they would both require the same height of tower. The tension on the copper-clad cables is very much higher, consequently the towers would have to be of heavier sections in this case. It is more than likely that in the majority of cases aluminium-steel cables would be used for the standard conductor with a copper-clad conductor of smaller section for any abnormally long spans. Very long spans (e.g., the Straits of Carquinez, California, 4400 feet; and the new crossing of the St. Lawrence, 6600 feet) are always operated with plow-steel cables because the necessity of maintaining clearance above a navigable waterway calls for the minimum sag. In installations of this kind, however, it will sometimes be found that a compound conductor, whilst yielding a greater sag than steel, will require much lighter and cheaper towers, due to the lower tension.

Before leaving the subject of sag calculation, attention might be drawn to the fact that the equations in this article are based on the assumption that the wire lies in a parabola, whereas the actual curve is much nearer a catenary. As a matter of fact, however, the small percentage error introduced is much less than that existing in the assumptions of the physical properties of the material. No authentic tests have been published to demonstrate whether the value of E for copper cables is correctly assumed at 16 x 10^6 and this figure is quite probably 10 per cent., and possibly 15 per cent. in error. Until these properties have been thoroughly established the laborious calculations involved in the catenary method are at least an inconsistency.

[The third article of this series will appear in the issue of March 1, and will deal with "Poles and Towers."—Ed.]

Reorganization of Power Situation in England

The situation as regards fuel and power in England is such as to demand greater economies in operation, and some time ago a coal conservation sub-committee of the University of Reconstruction was appointed. Their report has just been tabled and the following summary made public. A main feature is the organization of some 600 smaller systems into 16 districts, in each of which the generation and distribution shall be under one head. These, after the war, should be gradually superceded by more efficient and modern equipment, so planned and located as to be capable of extension. Existing inefficient plants should not be allowed to extend or enlarge. The recommendations, so far as published, are as follows:

Recommendations

(1) It is essential that the present inefficient system of over 600 districts should be superseded by a comprehensive system in which Great Britain is divided into some sixteen districts, in each of which there should be one authority dealing with all the generation and main distribution.

(2) Centres, or sites, suitable for electric generating purposes should at once be chosen on important waterways, as the future main centres of supply for each of the districts into which the country is to be divided.

(3) The sites so chosen should be as large as possible, having in view the land available in suitable localities, and should have ample water and transport facilities. Land is required not only for the power stations themselves—which for the sake of security and safety would have to be suitably sub-divided, that is, they would not be contained all in one building—but for the processes involved in the extraction of by-products from the coal before it is used for the production of power, where such extraction is found to be justified. It is also required for the development of electro-chemical processes, which may be most conveniently carried on in close proximity to the power plant. This condition entails the sites being chosen outside, not inside, towns. (The health of the great industrial centres and the congestion of the railway lines in their neighborhood would be radically improved by arranging that the conversion of coal into motive power was carried out away from the densely populated centres).

(4) Plans should be prepared for the construction immediately after the war on these sites of the first instalment of large super-power plants capable, first, of supplying, through a comprehensive electric power distribution system which must also be arranged for, the existing demands of the community; and, secondly, of supplying electrical energy at the lowest possible price for new processes and manufactures.

(5) Such plants would be designed so that, as methods

are perfected for extracting by-products from the fuel, before using it for the purpose of the production of electric power, the by-product plant can be combined with the power plant. Each site should be laid out with this in view, and with a view to the unrestricted extensions of the plant as required.

(6) Power available from surplus gas or waste heat should be turned into electrical energy on the spot in local plants which would feed into the main distribution system. As regards waste coal—i.e., coal which it does not at present pay to bring to the surface—this could, where transport was the ruling consideration, also be used on the spot.

(7) Once these plants are in existence it would be possible for existing authorities, without any risk of being left in the lurch, to stop extensions of their own uneconomical stations, situated as they mostly are on cramped and unsuitable sites, and to arrange to take their power from the main system.

(8) With a view to carrying out the policy advocated a Board of Electricity Commissioners should be appointed, with full powers to deal with the electricity supply situation throughout the country. They should have power—inter alia:—

(a) To stop the extension or multiplication of uneconomical stations for public supply.

(b) To arrange for the handing over, on equitable terms, of the generation, transmission and main distribution system in each of the areas into which the country is to be divided, to a new electricity body appointed for the area.

(c) To standardize for each area the frequency and voltage of the main transmission and distribution system.

(d) To settle for each area whether such body should consist of a Parliamentary company working under adequate control as regards limitation of dividends, etc., or one of the other alternatives given in Appendix C.

(9) Alternative types of the new electric power organizations are described in Appendix C. In reference to these alternative types the Sub-committee are impressed with the special need for initiative and resource in the management of the business of power supply, and they are of the opinion that the freedom of range and keenness which are distinctive of private enterprise will be found to be in a high degree conducive to the fullest measure of success. The Sub-committee consider that if the nation is to get immediately an efficient power supply, and is to take advantage of the temporary lull in manufacturing output immediately after the war, State assistance in some form may be necessary.

Rapid Growth of Southern Canada Power

Organized in 1913 They Have Developed Rapidly Until They Now Control the Development and Supply of Power Over a Wide Area

We have in previous issues emphasized the enormous growth in the demand for electric power in the Province of Quebec, due in a large measure to activity in industrial centres consequent on war conditions. On occasions this demand has threatened to exceed the supply, and has compelled considerable extensions to the plants. The Southern Canada Power Company, Ltd., serving a wide field in the Eastern Townships of Quebec and just over the border, has shared in this increased requirement for power. The company has shown a very rapid growth in the area it covers, and consequently in its earning power. From small beginnings in 1913 it has become an important factor in the power situation in the province, and, as it possesses some important undeveloped water-powers, it is likely to occupy a much stronger position in the near future. It is pretty generally recognized that Quebec, with its natural resources, has not yet attained anything like its ultimate standing in the matter of industrial development, and the possibilities of the Southern Canada Power Company must not be overlooked in summing up the general situation.

The area of the company's operations is approximately 100 miles east and west by 60 miles north and south. A glance at the accompanying map will indicate that the district is both industrial and agricultural, that it is exceptionally well served by railways, and that there are ample opportunities for development. At present the system is in the making, and it will necessarily be some time before the company will be able to realize to the full extent anything like the possibilities presented.

The company was organized in 1913 to acquire six water-powers on the St. Francis River, the St. John's Electric Light Company, La Cie de Gaz, Electricite et Pouvoir, St. Hyacinthe, and the municipal plant of the town of Drummondville. The water-powers are above and below Drummondville, and from Hemmings Falls, known as Power Site No. 1, to a point below the Moulin power, known as Power Site No. 6, the distance is 25 miles. These powers have been thoroughly investigated and reported on by Messrs. Viele, Blackwell, & Buck, of New York; the Stone & Webster Corporation, of Boston, Mass.; Mr. J. B. Woodyatt, the general manager of the company; Mr. J. M. Robertson, consulting engineer, Montreal; and Mr. W. I. Bishop, consulting hydraulic engineer, Montreal. The powers have a total head of about 300 feet, and are estimated to have a capacity of 90,000 h.p., 24-hour power, with storage to carry a peak of 150,000 h.p. Complete plans for the first two developments have been made, and a large amount of initial work done, so that the company is in a position to start at an early date on one or more of the powers.

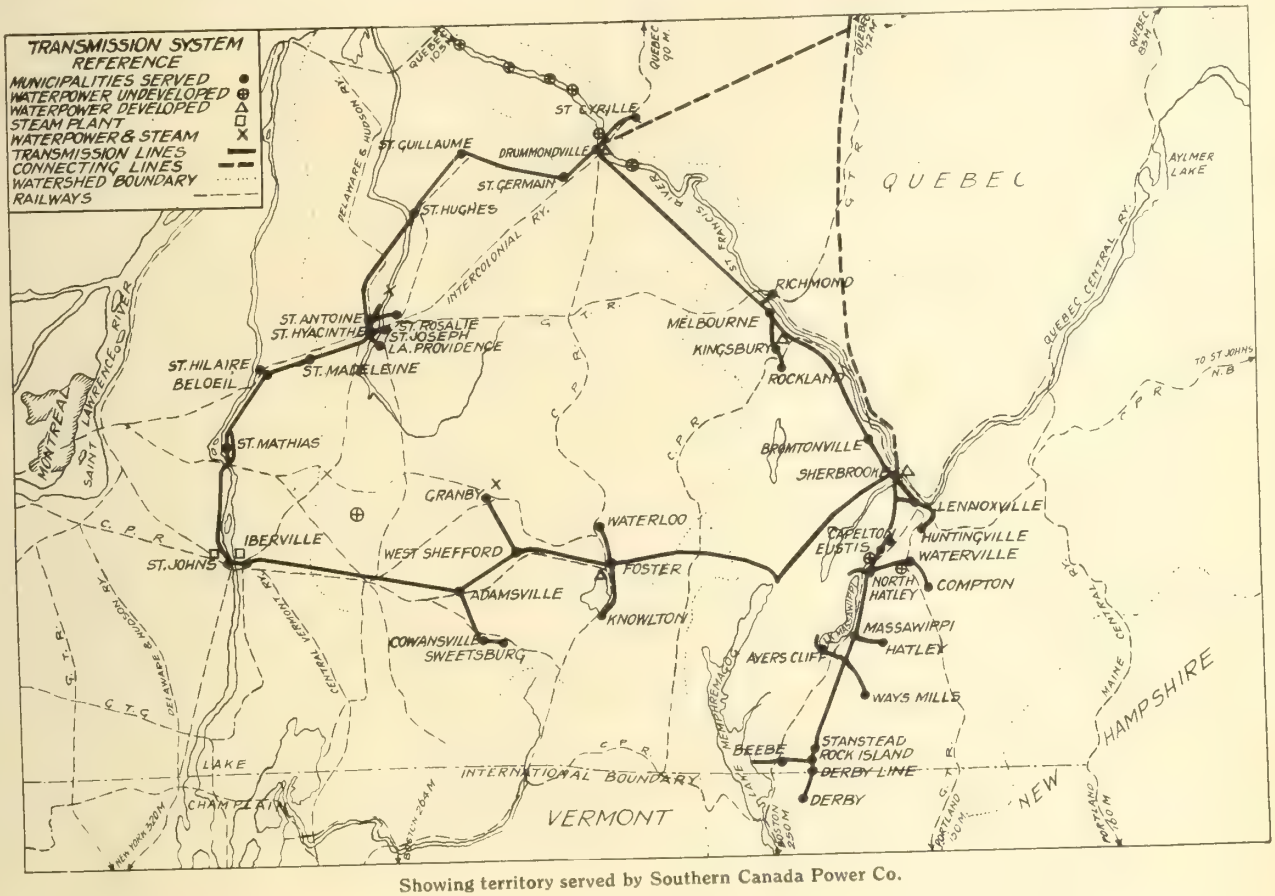
Besides this the company has powers on the Yamaska River, at St. Cesaire, St. Hyacinthe, Granby, and Foster; on the Magog, at Sherbrooke; on the Coaticook River, at Waterville; on the Massawippi River, at North Hatley; on the Tomofobia, at Rock Island; and the Salmon River, at Kingsbury. Hydro-electric plants are in operation at Drummondville, St. Hyacinthe, Sherbrooke, Richmond, Foster, Granby, and Cowansville, with auxiliary steam plants at St. Hyacinthe, St. Johns, Iberville, and Granby. The company also purchases power from the Shawinigan Water and Power Company, at Sherbrooke, and from the Montreal Light, Heat, and Power Company at Richelieu.

It will be seen from the foregoing that since 1913 the company has considerably broadened its field. It now controls, in addition to the original charters, the South Shore Power and Paper Company, Ltd., the Brome Lake Electric Power Company, Richmond County Electric Company, Sherbrooke Railway and Power Company, Lennoxville Light and Power Company, Eastern Townships Electric Company, Stanstead Electric Light Company, Burroughs Falls Power Company, and the International Electric Company of Vermont. The most important recent acquisition was the Sherbrooke Railway and Power Company, which, in addition to giving transportation facilities with ten miles of rails, supplies one of the busiest industrial districts in the province with power.

The following is a list of towns and cities served by the company and its subsidiaries: St. Johns, Iberville, St. Mathias, Beloeil, St. Hilaire, St. Madeleine, St. Hyacinthe, St. Hugues, St. Joseph, St. Antoine, La Providence, St. Rosalie, Drummondville, St. Germain, St. Cyrille, Richmond, Mel-

bourne, Kingsbury, New Rockland, Waterloo, Foster, Knowlton, Cowansville, Sweetsburg, Granby, Bromptonville Sherbrooke, Lennoxville, Huntingville, Massawippi, Way's Mills, Boynton, Libbytown, North Hatley, Capelton, Compton, Eustis, Waterville, Rock Island, Stanstead, Beebe, Beebe Junction, Ayer's Cliff, Hatley, all in the Province of Quebec; Derby Line and Derby Centre, Vermont.

The plants, it will be noticed, are located over a wide area, and, in order to link up the system and to consolidate it with a view to economical operation, it has been necessary to construct 200 miles of transmission line, in addition to which 100 miles are being built or will have to be built. The lines are on wooden poles. The transmission is 25,000 and 50,000 v., and distribution 2,200 v., 3 phase, 60 cycle, a.c.



Showing territory served by Southern Canada Power Co.

An extensive program of improvements to the electrical plants and to the sub-stations has been carried out. New sub-stations have been built and others altered in order to meet the altered conditions. Outdoor sub-stations are the rule in small places, and the indoor type wherever it is necessary to employ a switchboard attendant.

The company has adopted a progressive policy in the matter of inducing the public to be liberal users of light and power. It has established 14 stores, at the principal points, at which it sells various electrical household appliances, motors, lamps, etc., also undertaking wiring work where the local facilities are limited. Recently a further step was taken in this direction—sites at St. Hyacinthe and Granby were acquired, and large and attractive showrooms constructed, in addition to offices for the staff. At Granby a portion of the site was used for the sub-station. The idea, in the establishment of these stores, is, of course, to instil in the public mind the advantages of both light and power for household and industrial purposes.

The earnings of the company and the subsidiaries have enormously increased, from $104,442 in 1914 to $432,634 in 1917; the profits have risen from $41,756 to $211,722; and the surplus from $7,936 to $47,347.

The officers and board of directors have been strengthened from time to time by the inclusion of technical and business men. The president is Mr. W. C. Hawkins, managing director of the Dominion Power and Transmission Company, Hamilton, Ont.; the vice-president is Mr. F. W. Teele, formerly general manager of the Porto Rico Railways Company, Trinidad Electric Railway, Demerara Electric Company, etc.; Mr. J. B. Woodyatt, the general manager, and Mr. L. C. Haskell, the secretary-treasurer and purchasing agent, have been associated with the company from its inception. The directors are: Messrs. W. K. Baldwin, M.P., Baldwin's Mills, P.Q.; H. T. Chalifoux, St. Hyacinthe, P.Q.; James Davidson, Montreal; L. C. Haskell, Montreal; W. C. Hawkins, Hamilton, Ont.; C. J. McCuaig, Montreal; W. H. Miner, Granby, P.Q.; Lieut.-Col. J. R. Moodie, Hamilton, Ont.; Messrs. A. J. Nesbitt, Montreal; George Parent, K.C., M.P., Quebec; Charles E. Read, Ottawa, Ont.; J. M. Robertson, Montreal; F. W. Teele, Montreal; C. W. Tooke, Syracuse, N.Y., and J. B. Woodyatt, Montreal.

The head office is in the Coristine Building, Montreal.

The first electric furnace of the inductive type to be erected in South Africa was set up a few months ago by the Witwatersrand Co-Operative Smelting Works, under the auspices of the Chamber of Mines, for making steel castings, such as shoes and dies, for the mines from scrap metal. The British Trade Commissioner reports that between 70 and 80 tons of shoes and dies are now being turned out per month by this furnace, which is contributing very materially to requirements. The lining of the furnace at first presented some difficulties, but these were solved by the use of magnesite from Eastern Transvaal, calcined in Johannesburg. Two linings per month are required.

How the Power Conservation Order is Being Kept in Ontario

With very few exceptions, the light and power users of Ontario have loyally responded to the appeal, or order, of the power controller to conserve every possible watt of electric energy, to the end that it may be utilized more extensively in the manufacture of munitions of war. That the need is urgent is fully realized by everyone, and, from opinions gathered here and there, large power users are more than ready to curtail their demands, even to the extent of crippling their business and industries. It must be seen to, in every town and city, that all users comply fully with the order, for where less patriotic authorities ignore the rules laid down and their action is allowed to go unchecked, it will have a tendency to discourage the more considerate consumers. In one or two cases notice to the effect that the entire service would be cut off unless the rules were observed sufficed to bring certain offenders to a proper realization of the situation.

As instances of the extreme shortage existing among munition manufacturers, the American Cyanamid Company of Niagara Falls, which makes ammonia for use in the manufacture of high explosives, reported recently a 15,000 h.p. shortage in their usual power supply and the consequent curtailment of their output. The Union Carbide Company and the Electro Metals Company, two Welland concerns making war supplies, each reported about 15,000 h.p. short also.

Possibly the cutting off of even a small block of power is keenly felt by some of the smaller manufacturers not engaged on munition work, but among those using large quantities of energy it has been found that, by making slight alterations in the layout of shafting and machinery, it is often possible to take two, three, or four motors off the load.

In the matter of store lighting the majority of merchants are co-operating to the fullest extent. In St. Thomas the local hydro commission threatened to discontinue the service of a few stores disobeying the order. An appeal was made to all power users, with the exception of munition plants, and many responded by shutting down their factories half an hour earlier in the evening, in addition to cutting off motors wherever possible. It is estimated that the load in this city has been reduced almost 50 per cent. Some typical examples follow:

In Welland the street lighting has been reduced by 50 per cent., and all electric signs have been cut off. An urgent request has also been made to all power users to cut down their demand as much as possible.

In Galt a meeting of the large power users was held, and promises readily obtained to either reduce their loads or stop plants altogether on request. The total load in this city is 2,681 h.p., and an endeavor is being made to reduce it by 25 per cent. Several of the larger users stated that, by rearranging their machinery, many motors could be taken off the load. A table is being prepared by the local hydro commissioners, so that manufacturers will be in a better position to regulate the time of their maximum demands. On streets where there are single light standards all lights on one side of the street have been cut off, and where there are cluster lights two lights on each have been taken off.

The Hurlbut Shoe Company, of Preston, shortened their working day to five hours when requested to do so by the local commission. The manufacturers in this district have willingly been doing all in their power to conserve electric energy.

The Stamford Township Council decided to cut off all street lighting in the township until at least February 15, and in Niagara Falls all verandah and ornamental lights of all kinds have been cut off. It is proposed also to turn off street lighting at midnight.

In addition to the observance of other rules, the street car service in Guelph was discontinued except for an hour at noon and at nights.

The permitted peak load in Kitchener is 4,800 h.p. but the local commission have kept it under 4,500 h.p. with the co-operation of manufacturers. Street lights are not turned on until 6.15, and the rules regarding electric signs and display lighting are being enforced.

Chatham street lights are not turned on until 7 o'clock, and restrictions in store and sign lighting are being enforced. The city's maximum load of 1,000 h.p. has been reduced from 15 to 25 per cent. in the peak load hours.

Mayor Weaver, of Hespeler, stated it would be impossible to further reduce their load, as they already had it down to the limit.

The light commissioners of St. Catharines ordered that each alternate 100 watt lamp on the street lighting system be removed and that all 200 watt street lamps be replaced by 100 watt lamps.

The London and Lake Erie Railway Company cancelled their Sunday service and reduced the week-day schedule, bespeaking the indulgence of their patrons on the grounds of patriotic duty.

The Ontario Hydro-Electric Commission notified the Brantford Municipal Board of Street Railway Commissioners to reduce their load by 25 per cent., and, in accordance with this order, the car service was reduced from a ten to fifteen-minute service on the main line and a twenty-minute service on the line to Eagle Place. The running time is also much slower. Other retrenchments have also been made in street and sign lighting.

The Town Council of Petrolea, Ont., received notice from Hydro headquarters that from 7 a.m. to 9 a.m. only 85 per cent. of the maximum load of 300 h.p. was to be used; from 9 a.m. to 4 p.m., 75 per cent.; from 4 p.m. to 6 p.m., 85 per cent., and from 6 p.m. until 7 a.m., no restriction. Street lighting is not turned on until 7 p.m. Local power users were waited upon and arrangements made to comply with this schedule.

It is expected that about 3,000 h.p. will be conserved in Hamilton by the various recommended means. On January 15 all electric signs, display boards, show windows, and other electrical devices for advertising wares were turned off and each alternate cluster light in the down-town section has been taken off. Very few violations of the new rules are reported, and these are generally due to misunderstandings.

In Ingersoll the order was received to keep the load under 860 h.p., and men were sent out from the sub-station to request the local merchants and factories to shut off every unnecessary lamp and motor. As an instance of the steps taken in this town to comply with the order it was necessary on one occasion to shut off all the small motors in town about 2 o'clock in the afternoon. Between 5 and 6, in order to still further reduce the load, it was found advisable to shut off the stores and residences as far as possible. The Ingersoll Machine Company use the bulk of the power, and stores and residences will be shut off in order to keep this plant going.

Street lighting in Brockville has been so adjusted that in cases where five and three lights form a cluster only one lamp is permitted to burn. On other streets every alternate light has been taken off. Recently the lights on residential streets were turned off on moonlight nights, but the experiment was not entirely successful.

Probably one of the most strenuous objections to the new order comes from Tillsonburg, and a delegation was sent to Toronto to register a protest. On January 21 it was reported that the town was facing a serious water famine and probable

serious loss to manufacturers by reason of a twenty-minute notice given to the Tillsonburg Waterworks Company to shut off their electric pumps. The company have auxiliary steam power, but, of course ,their coal supply is inadequate.

On the main thoroughfares in Toronto every alternate cluster light is dark, and on the residential streets every unnecessary light has been turned off. The set rule in this regard is to turn out every alternate light, excepting in certain locations where good illumination is essential to public safety—in the vicinity of fire alarm boxes, on dangerous corners, etc. No single light standards on the car line streets have been turned out, owing to the possibility of traffic accidents. A suggestion to turn off the lights in the civic skating rinks and the various parks will not likely be carried out. It has been pointed out that the majority of these lights are not turned on until 7 o'clock. The down-town merchants have readily responded to the appeal to cut off window lighting at night, and Toronto's "White Way," which has been, on a smaller scale, a close rival to Broadway, New York, presents an entirely altered appearance.

Power Plant Carried by Latest Type of German Aeroplane

The Electrical Review prints an interesting article translated from La Nature of recent date, describing equipment carried by German aeroplanes for signalling purposes. It is understood that on account of noise messages cannot be be received—only transmitted.

The transmitting station on the latest type of German aeroplane consists of:—

1. A generator of d.c. and a.c.
2. The oscillating circuit.
3. The antenna.

1. At first the necessary current was provided by a storage battery. Difficulties arose, however; the batteries were very heavy, very fragile, and liable to be discharged rapidly. Small a.c. and d.c. generators were then fitted. These generators are driven by an air screw, or are coupled to the aero motor by a coupling (clutch) operated by the pilot. The generating plant, styled "J. A. Flieg, 1917," by the Germans, comprises two generators mounted on the same shaft. One of these, forming a simple dynamo, supplies the d.c., and is used for exciting the alternator, for the oscillator circuit, and probably also for lighting the lamps and projectors on the aeroplane.

The other generator supplies the a.c. for the oscillating circuit.

The three types of transmitter actually employed are the "Sender" type C, 1916, the "Huth transmitter," and the "Telefunken transmitter."

Underneath the alternator is a sort of case, into which 12 terminals lead. These terminals permit of inserting in the exciting circuit different values of a resistance placed in series, and housed under the generator.

According to the type of transmitter fitted on the aeroplane, these terminals are used with the corresponding types of current. For check purposes they are connected up by connecting plates corresponding to the transmitter employed, the connectors being small plates of insulating material.

In the cover of the case mentioned above is a small transparent window for observing whether the generator is properly regulated in respect of its oscillating circuit. The generators are constructed so as to work rotating either right or left, according as they are driven by air screws or by the aero engine. The type of generating set just described weighs, with its air screw, cables, etc., 10.3 kilograms (about 23 lbs.). The driving screw is designed to give a speed of 4,500 r.p.m. with a wind speed of 150 km. (say 90 miles per hour). Variations of aeroplane speed do not appreciably affect the output of the generating set. The set is air-cooled.

Transmitting Apparatus

The "Telefunken" apparatus comprises the usual parts, the whole being contained in a case measuring about 14 in. x 10 in. x 6 in., and weighing some 19 lbs. These parts are: a transformer, a condenser, a plate-type spark gap, and a variometer. There is a three-stud contact device for varying the intensity of emission by a rheostat in the excitation circuit, and at the same time decreasing the resistance of the spark-gap by short-circuiting part of the plates.

Another three-stud contact permits of employing three different wave lengths, viz., 150, 200 and 250 metres, by using one or more turns of an Oudin coil. The variometer (variable self-inductance) permits of tuning the aerial with the primary circuit. The observer knows that his circuit is properly regulated when the ammeter pointer attains a maximum.

The transmitting aerial is formed by a 1-mm. diameter copper cable about 40 metres long. This wire, which hangs below the aeroplane, tends to assume a nearly horizontal position by reason of its inertia and the wind resistance.

A special arrangement is provided for preventing the antenna swaying, and for ensuring that the correct length is unwound. The manipulator and ammeter are of the usual type. The conductors of this system are insulated and mounted in special flexible aluminium tubes.

The total weight of the complete set is as follows:—

Oscillatory circuit	8.7 kg.
Generator system	10.3 kg.
Aerial, etc.	3.7 kg.
Manipulator, wiring, and ammeter	3.0 kg.
	25.7 kg.

or, say, ½ cwt.

The mean range of the set seems to be about 35 kilometres, or something over 20 miles.

Every squadron of the German Army Service Corps attached to the air service includes a tractor wagon specially fitted up for dealing with repairs to, and tests on, wireless sets.

The Future of the Engineer—A Winnipeg Engineer's Views

Winnipeg, January 11th, 1918.

Editor, Electrical News:—

I have read with great interest in your issue of December 1st, the article entitled "The Future Place of the Engineer," and I have also read with further interest in your issue of January 1st, the classification of the new members of the Canadian Parliament, and it is particularly interesting to note that the engineers as a profession are not represented.

Your article in the January 1st issue, showing that no engineers are in the Canadian Parliament is one that should give all engineers that are proud of their profession and interested in the welfare of their country, food for thought. Much has been written and much has been spoken on the status of the engineer, the engineer's responsibility to society, and the education of the engineer, but how seldom do we see anything on the subject of the engineer's place in the legislative halls of his country. It has been said by many engineers that to feel that they are producers and constructors is sufficient reward in itself. That may be a very laudable

thought from the moral point of view, but in these days of stress and strain, the engineers as a body ought to realize that the very training that they have been fortunate enough to attain should put them in the forefront of all professional men, that they should be leaders of thought, leaders of public initiative, and help advance legislative conditions in the country in which they live.

Two of the greatest factors in the advancement of civilization today are light and transportation, both the product of the engineer, and still the very thought that engineers may not care whether they get the credit for the above or not is the very fact that their work has resulted in better conditions for humanity; but they must urge themselves to still further ambition in that they give wherever possible their time to the study and solving of some of the great questions in front of our legislative bodies today. What class of men are more fit for public life than engineers? The very fact that they deal with the stupendous forces of nature makes them inherently honest, one factor so essential to public life.

Engineers are modest to a degree, and unfortunately, often timid, when it comes to pushing themselves in the limelight, though this timidity may be due to a certain extent that as a body they cannot be accused of being public speakers; they should endeavor to cultivate this very necessary adjunct for public service, when they would undoubtedly feel in a better position to take their place on the public platform.

One of the reasons that lawyers and physicians have a certain status in the community is because they have interested themselves in public service, and to their profession has come a certain amount of honor that successful and honest public service should, and does bring, to the server.

Engineers having been backward in public service in the past—and when I say public service I mean some administrative position in public life—they are often put in a position where they appear to the general public as being lower on the professional ladder than the other professions.

For instance, a consulting engineer may be asked to make a report on some engineering or financial question for a certain town, and he is asked to appear before the corporate body of that town, present his report and possibly discuss same. On that corporate body may be the local butcher, baker and doctor, and almost invariably the local lawyer. The baker and the butcher defer more or less to the opinion of the doctor and the lawyer, and the two latter are generally looked on to decide as to whether the engineer's report meets with the requirements of the community or not.

Time and time again this has happened, engineers all over the country have had the same experience, and though the engineer may think he is doing the best he can for his country by making honest and correct reports, he would be doing a greater service for his country were he able occasionally to take his place in the legislative bodies that control civic, provincial and Dominion affairs.

I understand that the Canadian Society of Civil Engineers is endeavoring to stir up some interest in these matters, and the men behind this movement deserve every encouragement and help from their brothers in the profession, as undoubtedly by the engineer taking a greater interest in public affairs he will not only be doing something for the betterment of his country, but also for the betterment of his profession, and therefore himself.

True, sacrifices have to be made, and especially in the case of consulting engineers, who are in business for themselves, and have no large organization to carry on their work in their absence, but if ever the time has arrived for engineers to start and blaze the trail of placing their services as public servants before the electors, that time is present. Some engineers may say we can make more money by selling our services as engineers and not as public servants, but I submit that the status of the profession, and hence its monetary value to ourselves, will be raised if we take our place with other professions and let the public decide as to whether they would like us as some of their leaders of public thought.

What type of men more fit for the positions of Minister of Public Works, Minister of the Interior, Minister of Mines and Minister of Railways and Canals than engineers, and yet almost invariably these positions are filled by lawyers.

One reason that lawyers and physicians have been able to push themselves into public life is that they have tried to train themselves to be familiar with subjects outside of their own professions, and when they meet together they do not always discuss their own profession, or rather technical problems of their own profession, a habit that engineers are very prone to.

Art, literature, music, geography, history, finance and political economy deserve more than passing thought from every man, and to the engineer who wishes to be broad in his aspect these subjects are just as important as stresses and strains, reforestration and mathematics, and, above all things, a proper realization of the personal equation of those with whom you deal is a very essential factor to success, and is just as important to the engineer as to the doctor or the lawyer.

The engineer, more than all other men has it in his power to create a new era of real public service and to guide humanity. On the engineer, and such men who train engineers, rests a responsibility such as not many professions have been called upon before to face, and especially so as because upon us rests the responsibility of conscious knowledge of this fact.

In all matters pertaining to the war, engineers have done Trojan service. In fact in no small degree will it be the engineer who will be responsible ultimately for the destruction of that terrible and tragic ideal created by the common enemy, who the allies are endeavoring to crush. With the conclusion of the war a new world will arise, and the engineer must wake up and take his place alongside of the men of other professions and help create a better democracy at home, and this he can do by taking his just share in the public life of this great and wonderful Dominion of Canada.

May I take this opportunity of congratulating you on the stand you are taking in your paper regarding these questions.

Yours very truly,
Charles F. Gray,
Consulting Electrical Engineer.

Government Takes Over Niagara Power Plants

On December 28 the United States Government requisitioned the electric power produced, imported and distributed by the Niagara Falls Power Company, the Hydraulic Power Company of Niagara Falls and the Cliff Electrical Distributing Company. Disposition of the power and rules regarding its use will follow an investigation of the power and fuel situation in and around Buffalo by Robert J. Bulkeley, who is connected with the War Industries Board, and Col. C. Keller, U. S. Army, of the Chief of Engineers' Office in Washington.

The Main Electric Manufacturing Company have just issued their catalogue No. 100, which supersedes all previous issues, and is a complete catalogue of Main electric lighting plants for the farm. A copy will be supplied on request to the company.

The Dealer and Contractor

Get Rid of Your Dead Stock—It Does Not Pay to Hold Even if Prices are Going Up—Good Business Requires Up-to-the-minute Supplies*

There has never been a time when it was more opportune to move any dead stock that the electrical dealer and contractor has on hand than the present. In many instances it has been the practice of the central stations to sell appliances at prices which would not leave the dealer and contractor enough profit to enable him to compete with them. This day, however, has passed, probably never to return again.

To-day the price of coal, labor and everything else that enters into the cost of generating and distributing electricity have all increased. At the same time the demand for current has increased to such an extent that it is straining the capacity of the individual companies to meet the demand. These two facts remove the temptation to sell appliances for less than cost or at so small a margin as to monopolize the business with the end in view that the introduction of these appliances will increase the current consumption.

This condition of affairs is making it possible for the independent dealers and contractors to secure a great deal of business that otherwise would be beyond their reach. Most important of all, however, it is probable that never again will it be the general practice of central stations to sell appliances at a price which does not allow a fair margin of profit. Before this war is over there will be a great deal more attention called to this phase of the central station business than it has ever received before.

New Opportunities

With the cleaning up and revising of central station merchandising methods there will arise new and wonderful opportunities for the dealer and the contractor. Each of them will be able to expand his business in a way and to an extent that he has never been able to before. To prepare for this new era, however, it is necessary to clean up all the dead stock, the stock that one might be tempted to hold for higher prices. It is necessary to clean this up now, to sell all of it at once.

One of the complaints that central stations have made against dealers and contractors is that they do not go after business hard enough. They have claimed that if the central stations did not sell appliances they would lose much in the way of electric current sales. Possibly one reason why so few appliances have been sold in the past is because these dealers and contractors have not kept their stores as neat and attractive as have been the stores of the central stations.

You may reply that no dealer or contractor can go to the expense that the central station has gone in this respect. This statement is true, but it is not necessary to go to great expense to look neat and attractive. Few people refuse to wash their face and hands because they cannot afford to buy perfumed soap. It's not, after all, the expense that has been incurred so much as the thoroughness with which the work is done.

I have in mind the stores of two dealers. One is filled with old dirty stock. The whole establishment is far from attractive though it is housed in a substantial building and one which could be made to appear very attractive with clean, fresh stock and clean fixtures. The other store is housed in a smaller and a cheaper building but it is kept clean and the stock is all fresh and new. None of the stock in this store is allowed to die. It is all sold. There is nothing expensive about it but everything is attractive. Little things like fresh crepe paper are used to lend charm to the cheap tables and counters, show cases, etc., on which the goods are displayed.

Keep the Stock Moving

One of the reasons given for the success of large department stores and chain stores is that they very rarely have any dead stock. Some of these stores place tags on their goods which indicate to the salesman just how long it has been placed in stock, a blue tag may mean that it has been in stock for a month, a yellow tag that it has been in stock for two months, a pink tag that it has been in stock for three months and a red tag that it has been in stock for four months and must be sold at once. Each time a tag of a different color is placed on the goods the price is reduced and in all probability the price on the red tag is lower than the amount actually paid for the goods. However, it proves more profitable to sell them at a loss than to have the money tied up. The money working will soon earn the amount lost but the money idle will eventually lead to bankruptcy.

Let us take a concrete example. Suppose you have an article in stock that cost you $9.00 and that it is a good seller so you retail it for $10.00. Suppose that, due to the constantly increasing cost of raw material and labor, the retail price of this article advances 50 cents per month. In a year it will have increased in price $6.00. In other words, by simply allowing it to lie idle for a year a profit of $6.00 has been made on it. Surely it would pay to let stock become shelf warmers if the price was constantly increasing like this. Many a small dealer has been able to undersell the city department stores on certain commodities he had in stock for several months and at the same time make a profit for himself because of the difference in the methods of the large and the small retailers and due to the fact that retail prices have been climbing rapidly during the past two years. It would seem, then, that the retailer who has saved his stock has the advantage.

Let us go back and examine the case of the article which at the beginning of the year cost $9.00 and at the end of the year sold for $16.00, thus, by simply lying idle, showing a profit to the dealer of $6.00. Suppose that, instead of keeping that article in stock he had sold one a month at a profit of only $1.00. It would not require any more capital to do so than to hold the original one in stock for the money

* By J. E. Bullard in National Electrical Contractor.

received from the first one would buy the second, the money for the second one, the third, and so on to the end. The annual profit would have been $12.00, however, instead of only $6.00, and at the end of the year the stock would be fresh and attractive. The profit would also be in hand and not on the shelf, as in the case of the stock that had been held for a year.

Dangerous To Tie Up Money

It is easier to see that the stock ought to be turned as rapidly as possible to avoid loss when the retail prices are decreasing, but there is a tendency to hold on to stock when the retail prices are ascending, in the hope that the longer it is held the greater will be the profit. This feeling is preventing many a man from realizing upon the present market. He is still waiting for better prices rather than sell all his old stock now and turn it into money. No one knows how long conditions will exist as they are. All the big establishments, doing a retail business, however, do know that this is no time to hoard stock. They know that it is just as dangerous to tie up a lot of money in dead stock now as it is at any other time, and they are keeping their stocks moving.

No dealer can expect to compete for the best business until he realizes this fact. The mere act of clearing out all his old stock, some of which may have been on hand for years, and turning it into money now will help increase his business. He will be able to offer bargains in goods that are in perfect operating condition that will prove very attractive to many people. If he will follow up this clearing up sale with good fresh stock that is carefully purchased and is sold to the last article within a few months, even if it must be sold at a slight sacrifice, he will find that at the end of the year his profits on appliance sales have been greater than they have ever been before.

Now is the time to develop this business. As has already been stated, the central stations are not so likely to take as keen an interest in the sale of appliances as they would during normal times. On the other hand, the difficulty in securing coal is going to make many people use more electrical appliances than would otherwise have been the case. There will be a tremendous demand built up for electric ranges and other heating devices that would not exist if every household could without difficulty secure all the coal that it desired.

What Not to Do in Advertising—Some Warnings the Dealer Will Profit by, if He Heeds

A short time ago Mr. J. C. McQuiston, publicity manager Westinghouse Electric & Manufacturing Company, was asked by a prominent manufacturers' association to give them some points on advertising. Mr. McQuiston put his reply in the form of Don'ts," some of which are very much to the point. Here is what he said in part:

Don'ts in Advertising

Don't fail to advertise if you have something to advertise.

Don't advertise just because someone else in the same line does.

Don't leave the copy to the office boy's aunt. She can knit better than she can write advertising lines.

Don't forget that advertising is a part of selling—and selling is no joke.

Don't make statements that you cannot support in practice.

Don't make invidious comparisons.

Don't try to put a full page of copy in a quarter page space. Better put a quarter page of copy in a full page of space.

Don't fail to give your firm name in the same way—same type—and your address always.

Don't print a circular and then wonder what to with it. Study your market and as you do so, write your appea direct to the market. "From Kalamazoo direct to you."

Don't overlook the direct appeal to a customer. Don' fail to talk to your prospects in your circular letter, or othe correspondence, as you would talk to them face to face. B natural.

Don't forget to follow up your advertising.

Don't use all the type styles—rather have one dominating style and stick to it.

Don't pick a thin, skinny type—but one that has a bold courageous face—typical of strong and dependable business.

Don't give more than one bright idea in an advertisement. To do so may endanger your future stock.

Don't express in words what a picture can portray—use illustrations.

Don't run the same advertisement all the time. Change of copy makes your advertisements of continuous interest.

Don't buy space to please a solicitor. If you do, he will be the sole beneficiary.

Don't overlook the trademark. If you do not have one, make one, and show it in every ad. Also put it on stationery and all apparatus.

Don't be a spasmodic advertiser. It is the constant dripping of water that wears away the stone.

Don't advertise in one-time schemes, special issues, etc., and expect business in return.

Don't expect to be always able to check definite results. If you have no faith you had better leave advertising alone.

Don't overlook good will in your business, and the fact that you can make your advertising create good will.

Don't make your appeals in the negative, as "You don't want this," or "You don't want that." The phrasing should be positive and strong, as "You do need this," and "You do need that."

You should also avoid interrogation if you would make your appeals strong. For example, "Do you not think that it would be well to do this?" "Will you not stop to consider?" The appeal should be positive and direct. "Stop to consider." "Of course you think it would be well to do this or that." Imagine someone approaching you to sell some tickets to a charity supper and using such an appeal as "You don't want to buy a ticket for this or that." Think how easy it is to say "No." Think, on the other hand, how much easier it is to get the response "Yes" when you say, "Of course you want to help out this or that charity by buying a ticket to this or that supper." The "Yes" is almost as sure to come as the "No," when the right presentation is used.

Don't think because you know your business that you can also be a top-notcher advertiser. The wise business men call in advertising specialists to prepare their advertisements, just as they retain attorneys to keep them out of lawsuits, and patent lawyers to protect their patent rights.

Finally, don't forget that advertising should portray the sort of a business house yours is. If your advertising be ever so good—indicating order, soundness of credit, promptness of delivery of goods, quality of product—and then in all or some of these things your practice falls short of your claims, the advertising stands out as a glittering lie. Therefore you should strive just as earnestly to prove your claim in business practice as to announce them in printers' type.

Notice was mailed under date January 15, 1918, by George D. Leacock, sales manager, that the Moloney Electric Company of Canada, Limited, have opened a branch office and warehouse at Halifax, N.S., for the Maritime Provinces. Mr. E. A. Scath has been transferred to Halifax from the Montreal office and will have charge of this territory.

Quebec Province Will License Electrical Contractors—Bill to be Introduced at next Session

Electrical contractors in the Province of Quebec will be interested in a bill which is to be introduced by the Hon. L. A. Taschereau, Provincial Minister of Public Works and Labor, with a view to greater protection of public buildings from fire. The bill will compel the licensing of persons and firms installing wiring, electric lighting, and heating systems, the licenses to be issued by the provincial government. Such a regulation will involve examinations to determine the competency of those requiring licenses. Apparently the idea is that fires are often caused by defective work in wiring, etc., and that certificates of competency will make for more efficient sub-contractors and workmen, and thus for the better protection from fire.

At present there is no system of licensing, compulsory or otherwise, the inspection of wiring, etc., devolving on the electrical inspection department of the Canadian Fire Underwriters' Association, with the head office in Montreal. The inspection of public buildings and residences is supervised by the department, under an arrangement with the fire insurance companies and with the lighting and power companies, and also, in two or three instances, under municipal by-laws. The department covers all the more important places in the province. By the provincial building laws, it is provided that, at the direction of the government inspector, a certificate of the underwriters' bureau must be produced in the case of moving picture houses and theatres.

It is possible, under the present arrangement, for alterations to be made to residences without the knowledge of the insurance companies, although in the case of public buildings the periodical inspections constitute a safeguard against this sort of thing.

Many of the substantial contracting firms have advocated the compulsory licensing of contractors and workmen as the only method by which competent men can be trained, and also by which incompetent men can be barred from starting in business. Any wireman, with only the most elementary knowledge, can now set up as an electrical contractor, with the result of poor work and of ruthless cutting of prices.

A Yearly Sales Schedule for the Man Who Looks Ahead and Plans Accordingly

The Westinghouse Company recently compiled the sample yearly schedule reproduced below, for the guidance of retailers of electrical appliances. The underlying idea is that such a schedule should be prepared for the whole year, well in advance, and that it should govern the efforts of the retailer at the various seasons of the year. Special attention has been paid to two general principles, (1) that there is one or more seasons in the year in which each individual item is more saleable than at any other time, and, (2) that every item of merchandise should receive its just share of sales effort.

This schedule does not necessarily mean that these items must be advertised extensively; that will depend on the dealer's own judgment. It does mean, however, that the dealer knows in advance what he is going to concentrate his attention on next. It means that for the day or week, as the case may be, he makes a special drive on one particular line. At least this item will form the basis of his window display. If he advertises in the local papers it will be the special feature. In addition he will display it prominently in his store and, possibly, offer some inducement to increase his sales in that particular article. For example, a customer may come in to buy an iron but, seeing a special display of toasters, may be attracted to purchase one of them also.

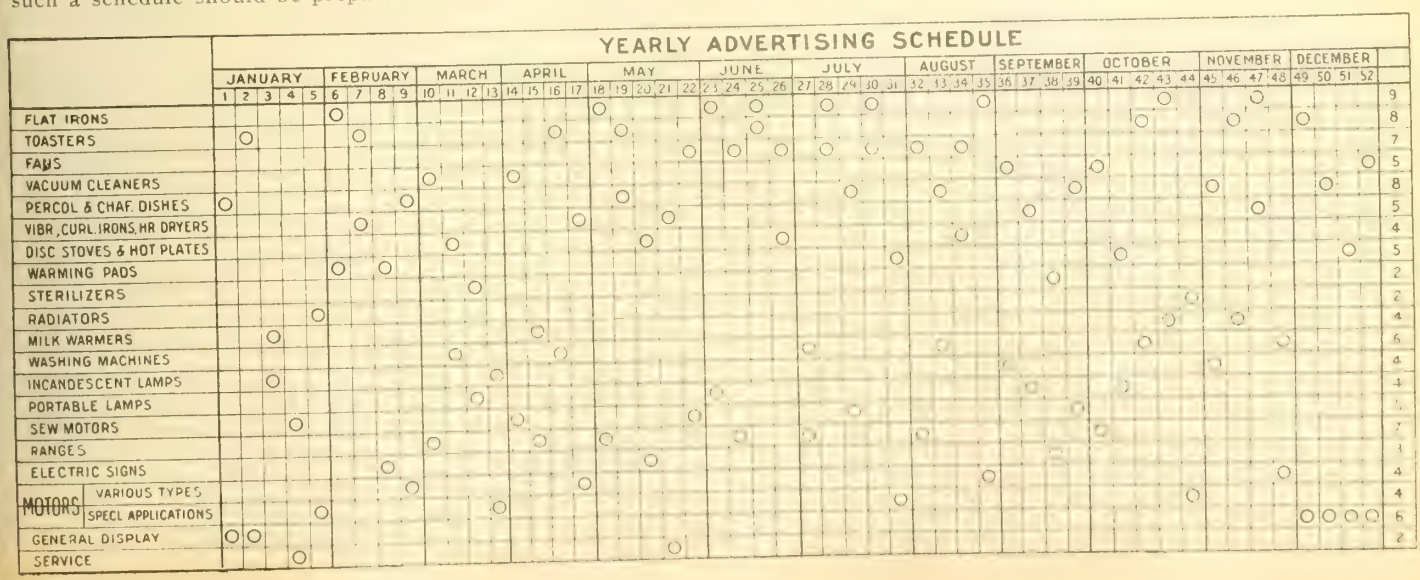
Even if the plan does nothing more than lead the dealer to plan "ahead" and carry on his merchandising systematically, the preparation of such a schedule is well worth the effort.

Toronto Electrical Contractors Hold Successful January Meeting

The regular monthly meeting of the Toronto Electrical Contractors' Association was held on January 10. About fifty members attended the dinner and this number was considerably augmented during the evening. As previously announced, it was a sort of "Members' Night," the main program taking the form of a description of original ideas and ways of overcoming difficulties met with by members in the ordinary pursuit of their business. A number of very helpful ideas were brought to light, from a description by Mr. Rooke of his latest form of switch box to Mr. Davenport's explanation of the use of vinegar in loosening corroded nuts, screws, etc.

The February meeting will be held on Thursday, February 7, when Mr. Beach will explain to the members a simple method of accounting, suitable for the needs of a majority of the members.

Don't forget the date of the meeting—February 7th; or the place—the Carls-Rite; or the hour—7.30 sharp. A proper system of accounting may easily save any member the price of his association expenses many times over.



Geyser Electric Washing Machine

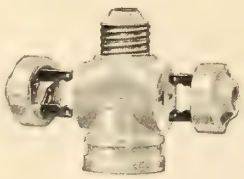
The illustration herewith shows the "Geyser" electric household machine manufactured by the Onward Manufacturing Company, of Kitchener, Ont. The principle of this machine is that, by means of a high speed propeller in the bottom of the tank, hot suds are forced through the clothes which are contained in a constantly revolving cylinder. It



is claimed by the manufacturers to be very compact, simple in construction, light weight, noiseless in operation and attractive in appearance. Above all, it is said to wash the clothes absolutely clean without any wear on the clothes. The washer is made in three sizes, with swinging or stationary wringer.

Hubbell Current Tap

The convenience of the current tap used in connection with socket outlets is becoming so fully recognized that Harvey Hubbell, Inc., are supplementing their standard single outlet current tap with a new one providing two plug outlets



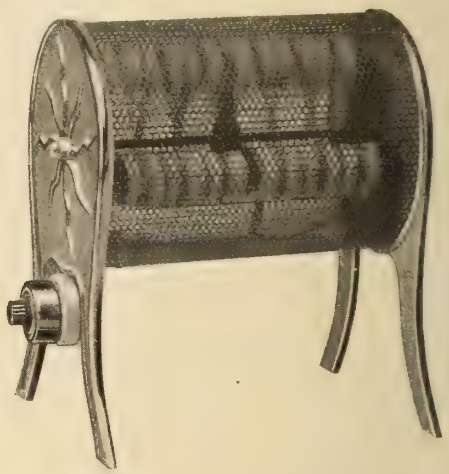
in addition to the lamp outlet. This device is constructed throughout of porcelain, is fitted with shade holder groove and slots so designed as to accommodate any one of their different styles of interchangeable plug caps. The new device is known as current tap No. 6553.

A new catalogue, No. 47901, has just been distributed by the Canadian General Electric Company, on Sprague panel boards and cabinets. This catalogue is 70 pages of 8 in. by 10 in. size, giving in most complete form all data and information necessary for panel boards.

The Crouse-Hinds Company of Canada, Limited, have issued an illustrated folder entitled "Condulet Suggestion No. 1." This will be followed by others of the same series.

Superior Electrics

As recently announced, a new manufacturing concern operating under the name "Superior Electrics" has commenced operations in Pembroke, Ont. Electric household appliances of various kinds will be placed on the market to be added to as business conditions demand. Already such every-day devices as irons, toasters, toaster-stoves and heaters are on sale. Mr. Charles E. Breckenridge, formerly of the Renfrew Electric Company, is managing director and thus brings to bear a wide experience in the management



of this particular line of business. The heater illustrated herewith is one of their several lines that have already established themselves.

Hart Accumulator Company Have a Bumper Year

The Canadian Hart Accumulator Company, Limited, St. Johns, P.Q., report a very successful year during 1917. In their Stationary Battery Department the works have been on overtime most of the year, carrying out orders for large batteries for submarines, transports, wireless stations, telephone exchanges and town lighting. The Train Lighting Department has also had a most successful year, having obtained orders from the C. P. R. and G. T. R. for electric lighting equipments for their dining cars, sleepers, etc. The greatest advance, however, has been made in the Automobile Self-Starting and Lighting Battery Department. Mr. Geo. Archdeacon, A.M.I.E.E., general manager of the company, has given special attention to developing the M. S. L. Battery, and has concentrated on its production. He reports that his labors in this direction have resulted in a most gratifying success, as during the 1917 season over 3,000 batteries were sold throughout the Dominion. The company state that their strong card is "Deliveries," as they can make shipment within 30 minutes of receipt of order.

Automatic Electric Iron

An electric iron equipped with a switch which opens automatically when the iron is not in use, is announced by a United States manufacturer. A switch button is located in the forward part of the handle, just where the thumb ordinarily rests. Under normal ironing conditions, the thumb presses against the switch button and keeps the iron in circuit; removing the thumb cuts it out of circuit. By means of this switch button, the current may be cut in and cut out at will by the operator, merely by moving the thumb. This will be found convenient when ironing lighter fabrics, the heat being shut off when not needed to prevent scorching.

Fans—The Robbins & Myers Company are distributing Catalogue No. 1117, dated January 1, 1918, describing and illustrating their line of non-oscillating, oscillating, ceiling and ventilating fans and hat cleaning motors.

A High Voltage Series Relay

The Canadian General Electric Company has recently made several improvements in its high voltage series relay used for the automatic tripping of oil circuit breakers. As illustrated, the mechanism of the relay consists of two main elements, joined by a wooden rod. The upper element—solenoid, counterbalancing weight, and a mechanism for transmitting the motion of the solenoid plunger to the operating rod—is mounted on a high-tension insulator and isolated from ground. The lower element—relay contacts, cover for contacts, calibrating parts—and time limit arrangement when



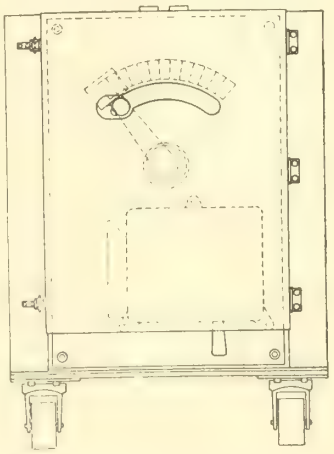
used—is mounted below the upper element. The solenoid is connected in series with the circuit, and one end of the coil is electrically connected to the solenoid frame to avoid static stresses. The solenoid coil and mechanism do not require adjustment after installation, and thus are not a source of danger to the attendants. When the solenoid or relay operates, the motion of the plunger is transmitted through the wooden operating rod to a set of double-break switch contacts which close when the solenoid plunger rises because of overload or short circuit and open again by the weight of the plunger when these abnormal conditions are removed. The oil circuit breaker tripping circuits are the same as when the more common secondary relays are used with circuit closing contacts. The current adjustments and the time delay setting are made at the lower end of the operating rod, and of course in safety to the operators. The relay is calibrated from normal to three times normal current. Current calibration is made by the sliding weight. Time delay adjustment is made by an oil dash pot shown. When instantaneous operation of the relay is desired, the time delay features are omitted. Contacts, mechanism, solenoids are the same for all voltages—that is, from 15,000 upward—but the coils vary in capacity according to the normal ampere capacity of the line. The insulators for mounting the solenoid will vary according to the line voltage and the factor of safety required.

Portable Outlet Panels for Electric Welding Service

For an electric welding outfit to be of its maximum service it must be so arranged that it can be taken to the work, no matter where it may be located. For instance, in a railroad shop there should be outlets adjacent to each stall in the roundhouse, one or more on the washing tracks outside, and others in places through the shop. In a boiler shop there should be an outlet on every other column, and in a large machine shop there should be an outlet adjacent to each of the larger machines, in order that work may be done in filling up blowholes and other defects on large castings with the minimum amount of crane handling. One solution of the problem would, of course, be to locate a panel outlet of a suitable type wherever it is anticipated that electric welding might be desired. However, this is rather an expensive proposition, and many electrical engineers would prefer to accomplish the same result in a simpler manner. A recently-developed portable outlet panel manufactured by the Westinghouse Electric and Manufacturing Company takes care of this situation with a minimum of expense and with all the simplicity of the familiar distributing system for storage battery charging.

Two types of portable outlet panels are furnished, both being mounted on light trucks. They consist of a control panel mounting a handle trip railway type circuit breaker having overload release, with magnetic blowout, and a 13-point face plate connected to a resister mounted in the rear of the panel. The face of the panel is protected by a metal cover, through which the handles of the rheostat and circuit-breaker project. The resister is made up of grids, and is protected by a cage of expanded metal. Type E panel is intended for metal electrode welding only, having a capacity of from 80 to 170 amperes. With this outfit one metal electrode holder and one shield are supplied. For a wider range of work a Type F panel should be used. This will handle metal electrode work from 80 to 160 amperes, and light graphite electrode work up to 300 amperes. The outfit includes one metal electrode holder, one graphite electrode holder, and one mask.

In installing an electric welding system using these portable panels, the best method is to place a Westinghouse arc welding motor generator set at some central point. Where suitable low resistance ground connection can readily be made throughout the shop, as, for instance, where metal floors or cast-iron bedplates are in general use or in a railway shop where the track system can be used, only one connector need be extended to the various receptacles. The iron floor plates may be arc-welded to each other and isolated sections tied together by an iron rod or heavy copper cable, while the track



rails may be bonded by arc-welding the fish-plates to the rails. Receptacles should then be provided at suitable points throughout the shop of a capacity appropriate for the service for which they are intended. These receptacles may readily be mounted out of doors if they are provided with protection from the weather. Only single-pole receptacles and a single wire cable to the portable panel need be provided. This cable should be of sufficient length so that the panel may be placed as near as possible to the work in order to save steps and valuable time for the welding operator. The flexible cable leading from the panel to the electrode holder should be as short as is consistent to the class of work to be done.

Where metal floors or tracks are not available, the ordinary two-wire system of distribution, with double-pole outlets and two-wire cables, should be provided.

To Patch Japan-Finished Surfaces

When the black enamel or japan finish on motors, generators, or in fact any electrical apparatus, has chipped off or has been knocked off by rough usage, common black paint is often used to cover up the spots. Such painted patches are scratched easily and soon lose their luster. A much better substitute can be secured by using the following mixture: Asphalt, one pound; lamp black, one-quarter pound; resin, one-half pound; spirits of turpentine, one quart, and enough linseed oil to make the lampblack into a paste before mixing it with the other ingredients. Mix thoroughly and apply with a varnish brush.—Electrical Review.

"Contact"—A New Westinghouse Dealer Magazine

To stimulate dealer interest and co-operation, the Westinghouse Electric and Manufacturing Company has begun the issuance of a monthly publication this month. This new paper is to be known as "Contact," and is the same size as the Saturday Evening Post, to permit effective display of its contents and full scale reproduction of advertisements in national mediums. The new magazine will replace the Westinghouse company's monthly "Merchandising Calendar," and also the special publications distributed on merchandising campaigns, which are issued from time to time throughout the year. The intention is to make "Contact" a clearing house of ideas for Westinghouse distributors. Whether these ideas cover window display, stock accounting, stock arrangement, canvassing or any merchandising problem, they will be welcome in its columns. New sales ideas, successful campaigns, plans for more business, for bigger profits, for better service from employees are being solicited by Westinghouse representatives throughout their trade. The first issue contains articles on getting rid of after-Christmas stock; bigger profits by better planning of advertising according to a definite schedule; sales letters that "bring home the bacon;" the value of the proper spending of our money in winning the war.

Personals

Mr. Philip Pocock was recently elected chairman of the London, Ont., public utilities board.

Mr. H. S. Shearer has been appointed manager of the Smith's Falls Hydro-electric System.

Mr. R. H. Long, formerly electrical superintendent of the Winnipeg Electric Railway Company, has been appointed power superintendent.

Mr. James Wilson, assistant secretary-treasurer of the Three Rivers Traction Company, Three Rivers, Que., has been appointed secretary-treasurer.

Mr. E. G. Mack, managing director Crouse-Hinds Company of Canada, has been elected a member of the Council of the Toronto Board of Trade.

Mr. Walter R. McRae, chief mechanical superintendent of the Toronto Railway Company, has recently been elected a member of the American Institute of Electrical Engineers.

Mr. W. R. Way, Montreal, of McGill University, has been awarded the Student's Prize of the Canadian Society of Civil Engineers for a paper on "Insulated Power Cables."

Lieut.-Col. C. H. Mitchell has been mentioned for the fourth time in despatches and, simultaneously, it is announced that he has been awarded the Croix de Guerre by King Albert of Belgium on the occasion of his recent removal to the Italian theatre of the war.

Major George C. Royce has been appointed Commandant of the Canadian Hospital at Bromley, Eng. Major Royce recently relinquished the rank of Colonel in order to get overseas. For some time previously he had been in command of the interment camp at Kapuskasing, Ont.

Mr. Howard Murray has been made an officer of the new Order of the British Empire. Mr. Murray was for many years connected with the Shawinigan Water and Power Company, as treasurer and vice-president. Several months ago he accepted a position with the Imperial Munitions Board, Ottawa.

Mr. Guy E. Tripp, of New York, heretofore chairman of the Westinghouse Electric and Manufacturing Company, has been appointed by the War Department as chief of the production division of the Ordnance Department, entrusted with the task of supervising and stimulating the production of all ordnance supplies. Mr. Tripp has been given a commission as colonel.

Mr. Charles F. Gray, M.I.E.E., M.A.I.E.E., consulting electrical engineer, Winnipeg, Man., was again elected, at the last civic election, to the position of Controller, in charge of Street Commissioner's Department, Fire Department, Civic Offices, Assessment Department, Building Inspection, Library and Public Baths. At the organization meeting of the Council Mr. Gray was also placed on the Police Commission.

Mr. Frank D. Laurie has been appointed manager of the Hamilton branch of the Bell Telephone Company, in succession to the late Mr. G. D. Richmond. Mr. Laurie has been manager of the company's branch at Chatham, in whose municipal life he took an active part, having been chairman of the Board of Education and also alderman. He is succeeded at Chatham by Mr. R. L. Stratton, manager of the company's Owen Sound exchange.

Lieut.-Col. Campbell Stuart, of Montreal, has received the title of Knight Commander of the Order of the British Empire. He is vice-chairman of the London headquarters of the British Mission to America. Prior to that he was in the employ of the Bell Telephone Company in Manitoba, subsequently becoming senior partner in the firm of Stuart, Drinkwater & Hingston, and vice-president and managing director of the A. B. See Electric Elevator Company of Canada, Montreal. After joining the Irish-Canadian Rangers as captain he was promoted to lieutenant-colonel and sent to Washington as an attache of the British War Mission.

Obituary

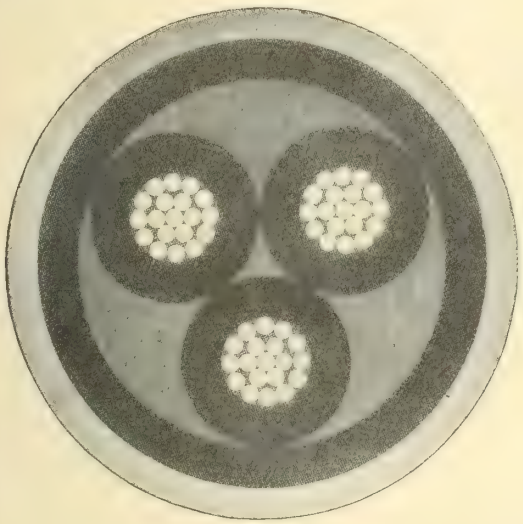
Mr. George Kenric Boright, formerly on the staff of the Canadian Westinghouse Company, died on January 10, at the home of his parents, Cowansville, P.Q., aged 33 years. He graduated at McGill in 1910, ranking second in the electrical engineering class of that year. Mr. Boright spent about a year and a half at the works of the Westinghouse Company, Hamilton, and later was transferred to Montreal, where for three and a half years he was on the technical staff. He was ill for several months, suffering from tuberculosis, and in September went to the Laurentian Mountains.

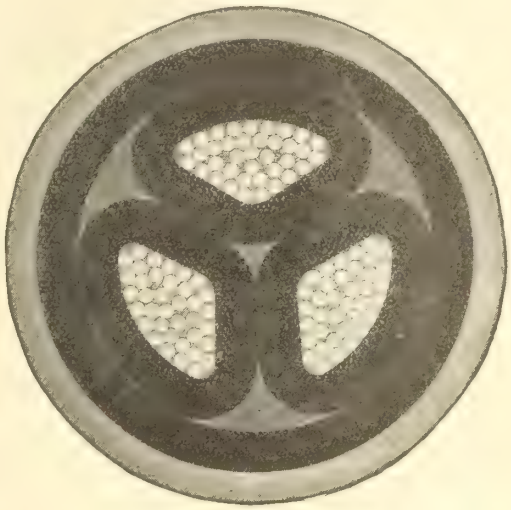
Mr. Charles B. Ellis, superintendent of supply sales of the Canadian General Electric Company, Montreal, died in the Homeopathic Hospital, after two weeks' illness, aged 41. Death followed an operation necessitated by an injury received in the Boer war. An Englishman by birth, he was for many years connected with the Canadian electrical business, holding a position in the Northern Electric Company prior to joining the Canadian General Electric a few months ago. There was a very large attendance of representatives of electrical interests at the funeral.

According to official statistics, during 1916 municipalities in the Province of Quebec increased their holdings in electric plants from $2,867,801 to $4,105,001, while those in telephone systems declined from $307,230 to $75,105.

PHILLIPS' CABLES

as supplied to the Toronto Hydro Electric System





These illustrations show cross sections in the original size of cables recently supplied to the T. H. E. System and reordered by them for further extensions. The specifications are as follows.—Conductors composed of 37 strands each, .082 in. diameter. Thickness of dielectric on each conductor, .210 in. Thickness in belt, .210 in. Thickness of lead sheath, .160 in. Overall diameter, 2.61 in., 250,000 C.M. Three Conductor, Paper Insulated, and plain Lead Covered Cable for 13,200 volts. We can supply you with wires and cables of any size for Power, Lighting, Telephone, Telegraph, etc.

Write us for detailed information.

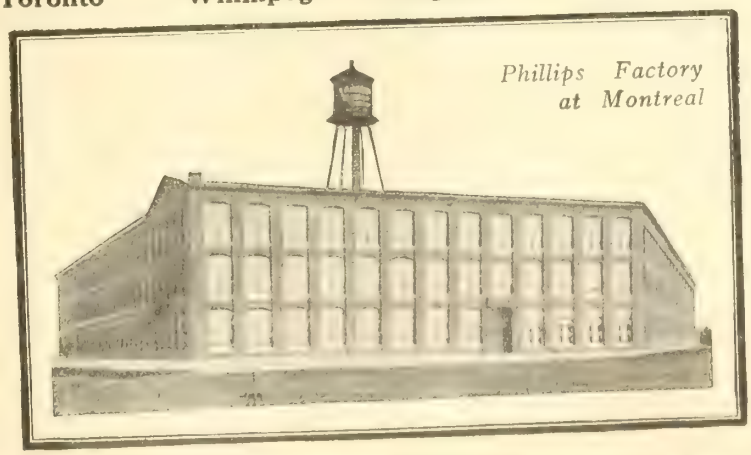
NOTE.—Specification of cable in left-hand cut: 3/0 B. and S. Three conductor. Each conductor 19 strands, each .094 in. diam. Thickness of dielectric on each conductor, .21 in. Thickness of dielectric on belt, .21 in. Thickness of lead sheath, .15 in. Overall diameter, 2.60.

Specification of cable in right-hand cut: As stated in copy.

Eugene F. Phillips Electrical Works, Ltd.

Head Office and Factory: MONTREAL

Branches: Toronto Winnipeg Regina Calgary Vancouver



Phillips Factory at Montreal

Current News and Notes

Alliston, Ont.

It is expected the Hydro transmission line from Barrie to Alliston will be completed as far as Cookstown shortly and that it will reach Alliston early in February.

Bassano, Alta.

The purchase of an electrically-driven pumping unit is under consideration by the Water Works Department, Bassano, Alta.

Coleraine, Que.

The Canadian General Electric Company has obtained the contract for the entire electrical equipment of the Bennett-Martin Asbestos & Chrome Mines, Limited, Coleraine, P.Q., for which Mr. M. A. Sammett, Montreal, is the consulting engineer. The equipment consists of three 300 kv.a. self-cooled, oil-insulated, 45,000 volt transformers; one 650 h.p.; one 275 h.p.; one 150 h.p., and one 25 h.p. induction motors; an automatic induction regulator; switchboard panels for the control of the motors, and some miscellaneous auxiliary apparatus. The equipment is of 30 cycles. A transmission line, 4 miles long, will be constructed, the insulations to be supplied by the Canadian Porcelain Company, Hamilton, and the wire by the Canadian Wire & Cable Company, Toronto. A contract for power has been closed with the Shawinigan Water and Power Company, connection being with a sub-station at Black Lake, P.Q.

Elora, Ont.

At a recent meeting of the Elora, Ont., Hydro-electric Commission Mr. T. E. Lipsey was elected chairman for the coming year. It was reported that the local system is in a splendid and paying condition.

Eugenia Falls, Ont.

Work is progressing favorably on the extension to the Hydro development at Eugenia Falls. This work includes the installation of a 4,000 h.p. unit and extension to the power house to include additional transformer capacity and switching equipment. It is expected the new unit will be in operation within four or five months.

Hamilton, Ont.

At a regular meeting of the Hamilton Hydro-electric Commission, held recently, Mr. T. J. Stewart was elected chairman for the year. The estimated annual revenue for 1917 was $123,650, as compared with $74,723 for 1916.

London, Ont.

It has been announced by the London Public Utilities Board that plans have been completed for a $60,000 addition to the Hydro power station.

Montreal, Que.

The Southern Canada Power Company, Montreal, are contemplating the construction of about 100 miles of high tension transmission line and have asked tenders on poles, cross-arms, insulators, cross-arm braces, wire and other material.

Nelson, B.C.

The Waneta Power Company, Limited, has been incorporated with a capital of $1,500,000; head office, Nelson, B.C. The new company will take over the development and assets of the Waneta Development Company, Limited.

Newboro, Ont.

The ratepayers of the village of Newboro, Ont., recently carried a by-law to have their electric lighting brought in from Bedford Mills. A 20-light incandescent street lighting system will be installed in the early spring. Supplies required by the manager of the Newboro electric plant.

Perth, Ont.

The Perth Hydro Commission, recently organized, consists of Mr. W. B. Hart, as chairman; Mr. J. H. Echlin and Mayor Hands. Mr. R. J. Smith is secretary.

Petrolia, Ont.

The Hydro-electric Commission of Petrolia, Ont., report that for the ten months ending November, 1917, the total revenue amounted to $15,407, as compared with $4,739 in 1916.

Rossland, B.C.

The annual report of the West Kootenay Power and Light Company for the year ending August 31, 1917, shows that the net surplus amounted to $30,930, as compared with $70,827 for 1916. This was, however, after writing off $99,736 for plant depreciation and providing $182,666 for dividends on preferred and common shares. For the year ending August 31, 1916, the revenue producing load was 11,152 h.p., and in 1917, 22,511 h.p. New contracts have been secured which promise to add very substantially to the company's earnings.

Stratford, Ont.

The work of building a new 26,000 volt sub-station at Stratford, Ont., and installing the necessary equipment is practically completed. All municipalities supplied from this station will receive their power at 26,400 volts instead of 13,200 volts as at present.

Sudbury, Ont.

It is stated that the impossibility of getting power at less than $46 per h.p. may lead to the British-American Nickel Company, of Sudbury, abandoning plans to erect a nickel refinery in that district. The company, it is further reported, is looking to Ottawa as a possible site, where the Hydro Commission have a surplus of power available for immediate use.

Toronto, Ont.

Negotiations are proceeding with a view to the acquirement by the Hydro-electric Power Commission of Ontario of the Essex County Light and Power Company's plant and business which is at present owned by the Detroit Edison Company and supplies power to Windsor, Walkerville, Sandwich and Essex.

The Hydro-electric Power Commission of Ontario have awarded contracts for two generators and turbines for the extension of their Ontario Power Company's plant at Niagara Falls. The generators, 15,000 kv.a. capacity, are being supplied by the Canadian General Electric Company. The turbines have been purchased in the United States and will be shipped immediately.

Vancouver, B.C.

An electric lighting plant will, it is understood, be installed at the shipbuilding yards of J. J. Coughlan & Sons, Vancouver, B.C.; also twelve electrically operated cranes.

Winnipeg, Man.

Gross earnings of the Winnipeg Electric Railway, according to returns made to the city, amounted to $1,088,756 in 1917, being a decrease of $1,322,413, or 40 per cent. The municipality gets five per cent. on gross, or $99,437, besides $20 on each car. Net earnings are not yet available.

Canada Wire & Cable Co., Limited
Head Office and Works, TORONTO

Bare and Insulated Electrical Wires for all purposes

Electric Railway Trolley Wire and Feeder Cable

Sales Offices and Branch Warehouses:
501 Merchants Bank Building, MONTREAL
592 Notre Dame Avenue, WINNIPEG
Northwestern Engineering and Supply Co., Ltd., CALGARY

Prompt shipments from Factory or nearest Warehouse



MICABOND

The Standard Mica Insulation

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Cloth
Paper
Washers
Tubes
Heater Plates
Flexible Plates
Washers

Mica Insulation for Moulding and Commutator Segments

THERE is a special Micabond insulation prepared for every electrical condition.

Micabond insulations possess unusual wearing qualities and are reasonable in price.

Send us your B/P's or samples and let us figure your motor requirements.

Chicago Mica Co.
VALPARAISO, Ind.
Address Dept. D.

BERMICO
KYANIZED
CROSS - ARMS
POLES AND TIES
are
PROTECTED
FROM DECAY

Manufactured In Our Own Plant From Carefully Selected Stock

Write for Samples and Particulars

BROWN COMPANY
FOUNDED 1852
Formerly Berlin Mills Company
PORTLAND - - - MAINE

Make Stronger Splices

Stop wire losses thru acid fluxes. Make stronger, safer splices with

ALLEN Non Acid Soldering Flux.

4 forms; solid, cored, slab and bar

3 times stronger than acid— can't start corrosion.

Sample for your Dealer's name.

Houston & Co., Limited
Cumberland Blk., Winnipeg
22 College St., Toronto
1825 Scarth St., Regina.

"In the Soderman's game since '03."



ALUMINUM

ELECTRICAL CONDUCTORS

Ingot Sheet Wire Rod Tubing

Northern Aluminum Co. Limited
1305-6 Traders Bank Bldg.
Toronto, Ont.

ELECTRICIANS

Send $1.50 for 14 Blue Prints of Motor Windings, A.C. single, two and three phase, and D.C. Winding made easy.

Elec. R. & S. Co.,
Box 233,
3-4 Sherbrooke, Que.

For Sale Cheap

85 Kw. Westinghouse, 250 Volt, D. C. Generator, 750 R.P.M. First class condition. Write to

The KAUFMAN RUBBER CO., Limited,
3-6 Kitchener, Ont.

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LONG EXPERIENCE IN PATENT LITIGATION
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FOR SALE

IMMEDIATE DELIVERY

NEW and USED

MOTORS

No.	H.P.	Phase	Cycle	Volt	Speed	Maker
1	35	3	25	550	500	C.G.E.
1	20	3	25	550	710	Wstgh.
1	5	3	25	550	1400	T&H.
2	75	3	60	550	900	C.G.E.
1	30	3	60	550	900	C.G.E.
1	20	3	60	220	1700	Wstgh.
1	20	2	60	220	1200	C.G.E.
3	15	2	60	220	1120	Wstgh.
1	200	3	60	2200	514	C.G.E.
1	300	3	60	2200	600	Wstgh. (Synchronous).

GENERATORS

No.	K.V.A.	Phase	Cycle	Volt	Speed	Maker
2	625	3	60	2200	225	C.G.E.
1	275	3	25	6600	375	Wstgh.
1	150	3	60	2200/550	600	C.G.E.
1	100	3	60	550	900	C.G.E.
1	75	3	60	2200/550	900	Wstgh.
1	50	3	60	550	1200	C.G.E.
1	25	D.C.		125	1100	Wstgh.
2	20	D.C.		125	550	Wstgh.
1	17	D.C.		125	1100	Wstgh.
1	12½	D.C.		125	1100	Wstgh.
1	5	D.C.		125	1100	Wstgh.

TRANSFORMERS

No.	K.V.A.	Phase	Cycle	Volt	Maker
2	60	1	60	10,000/2200	C.G.E.
2	15	1	60	2200/110/220	C.G.E.
2	10	1	60	2200/110/220	C.G.E.

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E. A. LOWRY
209 King. St. - GUELPH, ONT.

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NITROGEN and TUNGSTEN

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High Efficiency Lamp Co.

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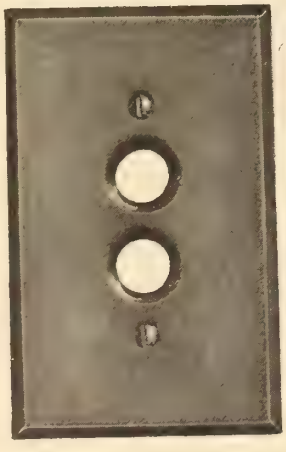
No.	H.P.	Phase	Cycle	Volts	Speed	Maker
1	50	3	25	550	850	Westg.
2	50	3	25	550	750	C. G. E.
1	40	3	25	550	750	C. G. E.
1	25	3	25	2000	900	C. G. E.
1	20	3	25	550	1440	J. & M.
1	20	3	25	550	750	C. G. E.
2	10	3	25	550	750	C. G. E.
1	7½	3	25	550	1400	Westg.
1	7½	3	25	550	720	Westg.
2	7½	3	25	550	750	C. G. E.
2	5	3	25	550	1440	Excelsior
2	4	3	25	550	1400	Excelsior
1	3	3	25	550	750	C. G. E.
1	2	3	25	550	1400	Excelsior
1	2	3	25	550	750	C. G. E.
1	1	3	25	550	1450	Excelsior

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43 Britain Street, TORONTO

3 Phase, 25 Cycle, 220 Volt MOTORS

Now Ready for Immediate Delivery

No.	H.P.	Make	Speed	Type
1	50	Allis-Chalmers	750	
1	50	General Electric	500	K
1	50	General Electric	750	K
2	10	General Electric	750	K
3	5	General Electric	1500	KT

Ready for Delivery in February

No.	H.P.	Make	Speed	Type
1	200	General Electric	750	K
1	150	Westinghouse	485	C
1	100	General Electric	500	K
1	100	General Electric	750	K
2	60	General Electric	750	K
3	35	General Electric	750	K
1	35	Westinghouse	1400	CCL
5	25	General Electric	750	K
3	20	General Electric	750	K
1	15	General Electric	750	K
6	10	General Electric	750	K
8	5	General Electric	1500	KT
11	3	General Electric	1500	KT
6	2	General Electric	1500	KT

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Selections from Our Stock of Motors

3 PHASE, 60 CYCLE MOTORS

Qu.	H.P.	Make	Volts	Type	Speed
2	½	G.E.NEW...	110	KT	1800
1	1	Fbks. M. ..	440	B	1200
1	2	Wstgh.	440	CS	1120
1	50	G.E.	220	M	960
2	3	R&M NEW.	220		1150
6	3	Wstgh. New	220	CS	1130
1	3	Cr.Wh.	220		1720
1	3	Fbks.M. ...	220	B	1200
2	2	G.E.	220	KT	900
4	3	G.E.	220	KT	1800
1	3	G.E.	220	KT	900
2	3	G.E.	220	KT	1200
2	5	G.E.NEW. .	220	KT	1800
3	5	Wstgh. New	220	CS	1130
4	5	G.E.NEW. .	220	KT	1200
2	5	Wstgh.	220	CCL	850
30	7	G.E.	550		1200
1	7½-15	Cr.Wh..	220/440		865/1735
5	7½	G.E.NEW. .	220	KT	1800
4	7½	G.E.NEW. .	220	KT	1200
6	7½	G.E.	550	KT	1800
2	7½	G.E.NEW. .	220	KT	900
2	10	G.E.NEW .	220	KT	1800
1	10	Wstgh.	220	CCL	1700
1	10	Wstgh.	220	CS	1150
1	10	Cr.Wh. . ..	550	Q	1800
3	15	R&M	220		1150
4	15	Fbks.M.	220/440	KBV	1200
1	20	Cr.Wh..	220/440		1200
1	20	Triumph	220/440		900
2	20	Wstgh. . .	220	CS	1160
1	20	Fbks.M. . .	220	B	1200
50	20	Fbks.M.	220/440	KBV	1200
29	25	Wagner.	220/440	BP	1120
1	25	G.E.	220	M	960
2	30	WagnerNEW	220		850
1	35	Triumph	220/440		900
1	35	G.E.	220	KT	600
1	35	G.E.	220	KT	720
1	40	Wagner NEW.	220/440	BP	850
1	40	Fbks.M. . .	220		900
1	40	G.E.NEW .	220	KT	1200
1	50	Triumph . .	220		720
1	50	G.E.NEW. .	220	KT	900
2	50	G.E.NEW .	440	KT	900
1	50	G.E.NEW..	220	KT	1200
2	75	G.E.NEW	220/440	K	900
1	125	G.E.	2200	L	600
1	150	Wstgh. New	440	CW	695
1	200	Wstgh. . .	2200	CCL	580
1	263	G.E. Synch. with direct connected exciter.....	2200		660

3 PHASE, 25 CYCLE MOTORS

Qu.	H.P.	Make	Volts	Type	Speed
1	5	G.E. . . .	220	KT	750
1	12½	G.E.elev.type-high torque	220	KTE	750
1	15	Wstgh. . .	440	CS	730
6	15	Allis-Ch. ..	220		750
1	15	Fbks.M. . .	440	B	750
7	20	Allis-Ch. ..	220		750
2	20	G.E.	440	K	750
6	25	G.E.	440	K	750
1	50	Allis-Ch. intermittent duty, sl. rg. drum controller	440		500
1	55	Wstgh.sl.rg. 30 cycles, complete. .	440		860
1	60/45/30	G.E.	440		500/375/250

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1—20 H.P., 850 R.P.M., 220 V., 2 Phase Westinghouse, CCL
3—10 H.P., 1120 R.P.M., 220 V., 2 Phase Westinghouse, CCL
2— 5 H.P., 1120 R.P.M., 220 V., 2 Phase Westinghouse, CCL
2— 5 H.P., 1720 R.P.M., 220 V., 2 Phase Westinghouse, CCL
1— 2 H.P., 1720 R.P.M., 220 V., 2 Phase Westinghouse, CCL
1— 2 H.P., 1720 R.P.M., any volt, 2 or 3 phase, Crocker Wheeler, to be wound.
3— 1 H.P., 1720 R.P.M., any volt, 2 or 3 phase, Westinghouse CCL, to be wound.
2—10 H.P., 1120 R.P.M., any volt, 3 phase, Westinghouse CCL, with Star Delta Switch.
1—20 H.P., 850 R.P.M., 220 V., 3 Phase Westinghouse, CCL
2—10 H.P., 1120 R.P.M., 220 V., 3 Phase Westinghouse, CCL
1— 5 H.P., 1120 R.P.M., 220 V., 3 Phase Westinghouse, CCL
1— 5 H.P., 1720 R.P.M., 220 V., 3 Phase Westinghouse CCL, rewound.
1— 3 H.P., 1720 R.P.M., 220 V., 3 Phase Westinghouse C, rewound.
1— 5 H.P., 1720 R.P.M., 220 V., 3 Phase Westinghouse, C

25 CYCLE MOTORS

1—50 H.P., 750 R.P.M., 550 V., 3 Phase, Can. Gen, Elec, Form K,
1—60 H.P., 750 R.P.M., 550 V., 3 Phase, Crocker Wheeler.
1—3½ K.W. Motor Generator, Westg., 110 V., D.C., 220 V., 3 Phase, 25 Cycles.

TRANSFORMERS

2—75 K.W., CGE, H.G., 60 cycles, voltage 1040/2080-115/230.
1—40 K.W., Packard R60, 60 cycles, voltage 2200-220,
1—40 K.W., Westg. C., 60 cycles, voltage 2200/1100-220/110.
1—2½ K.W., Packard R10, 60 cycles, voltage 1100/2200-110/220.

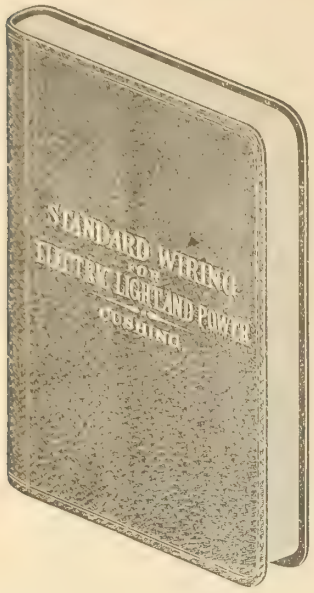
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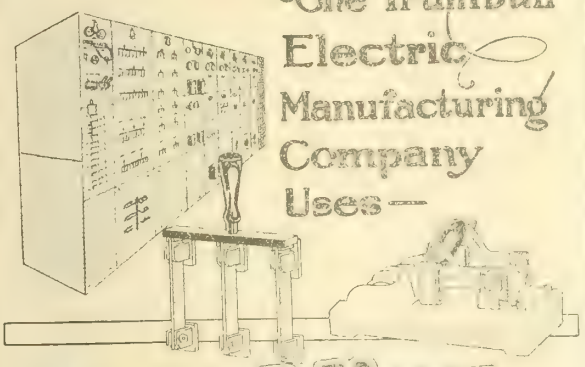
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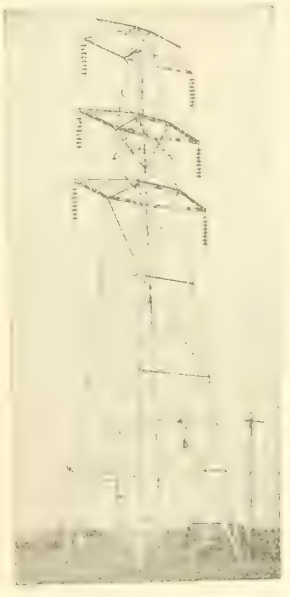
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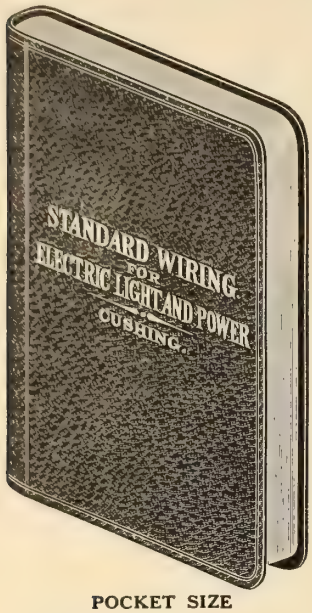
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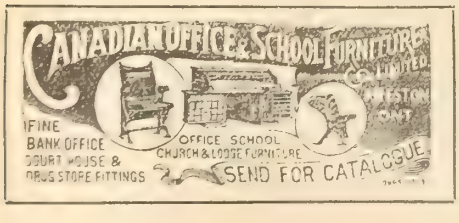
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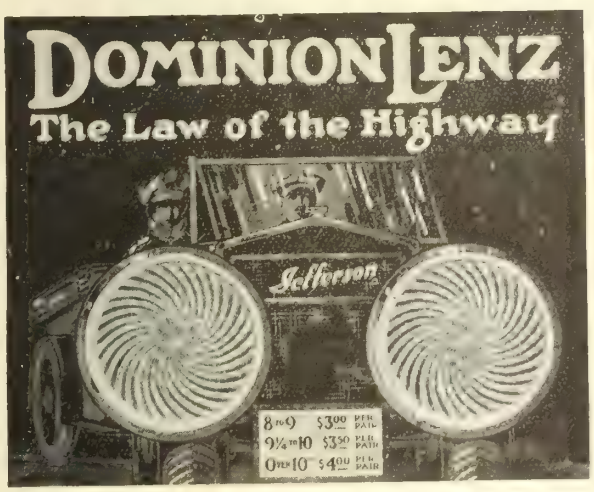
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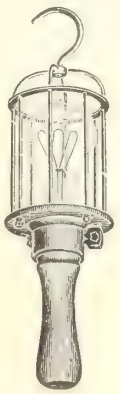
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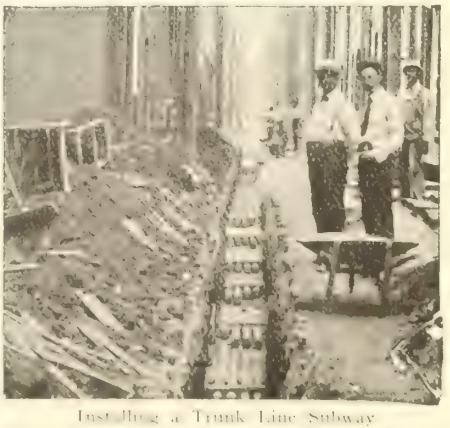
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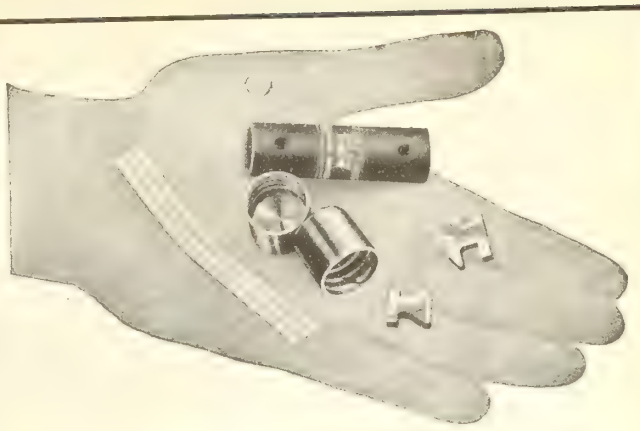
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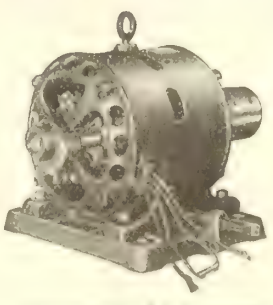
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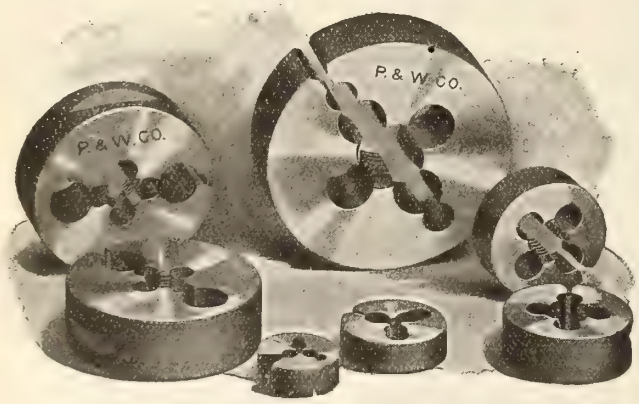
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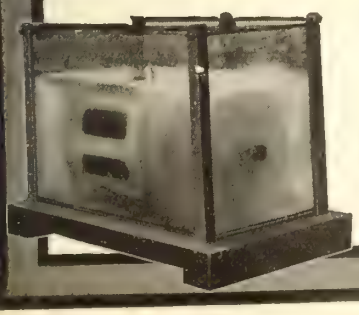
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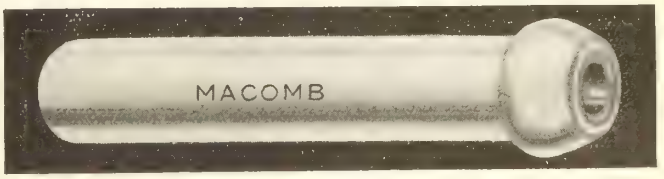
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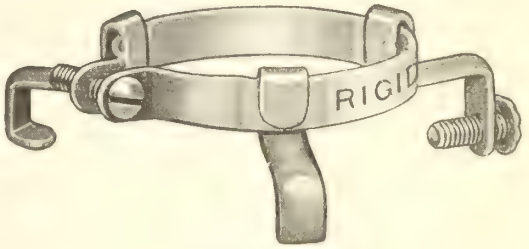
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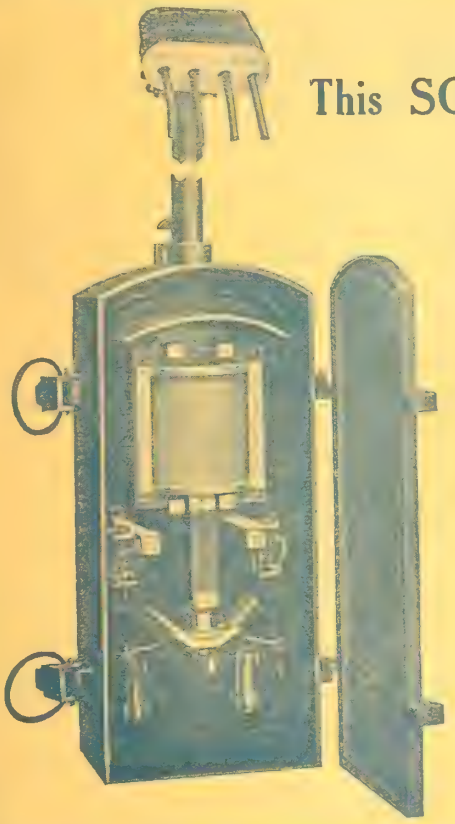
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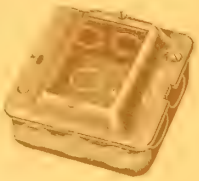
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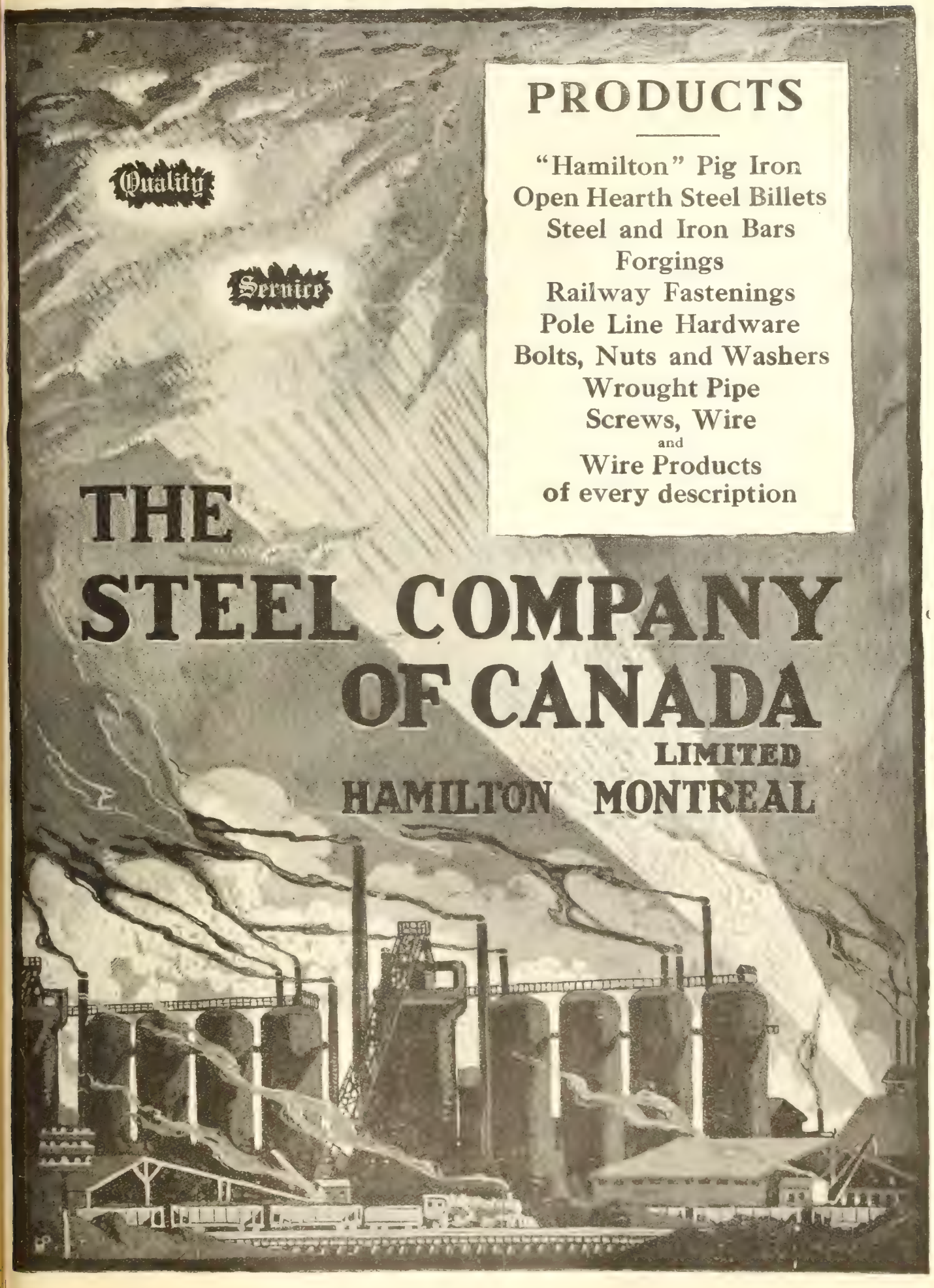
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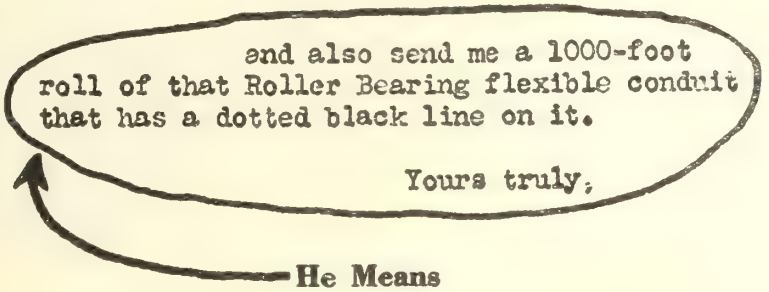
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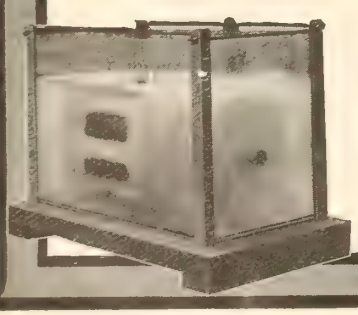
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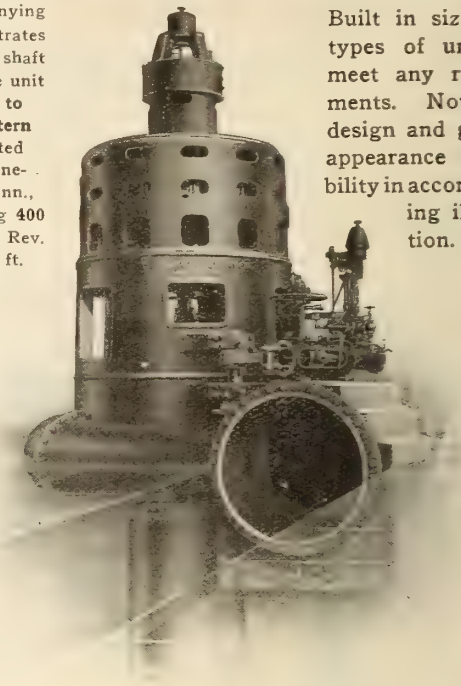


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Accompanying cut illustrates vertical shaft scroll case unit furnished to Northwestern Consolidated Mill, Minneapolis, Minn., developing 400 H.P., 450 Rev. under 45 ft. head.



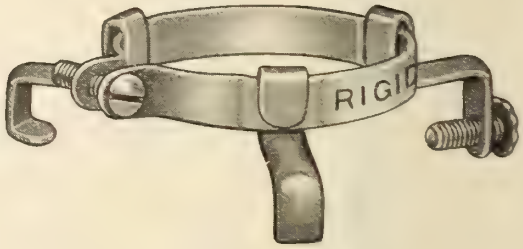
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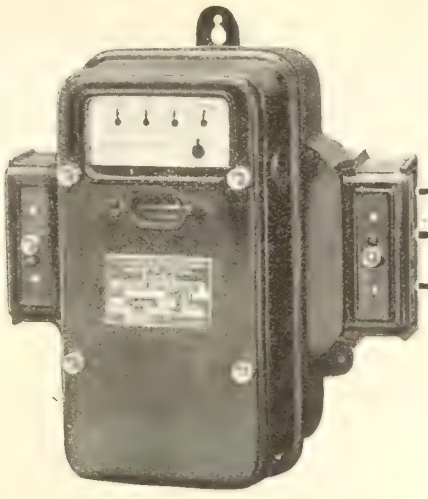
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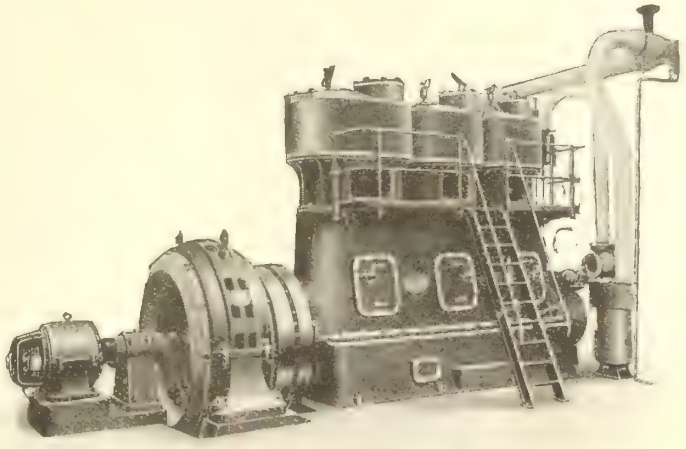
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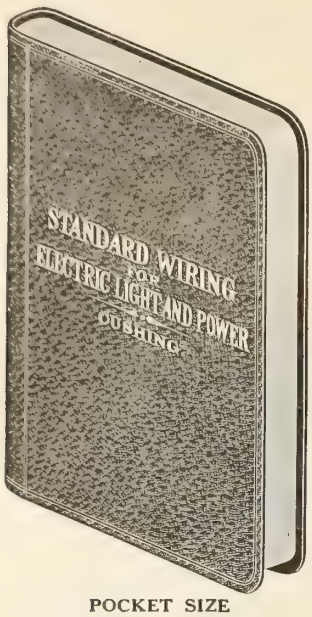
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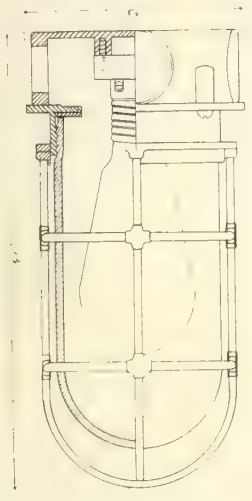
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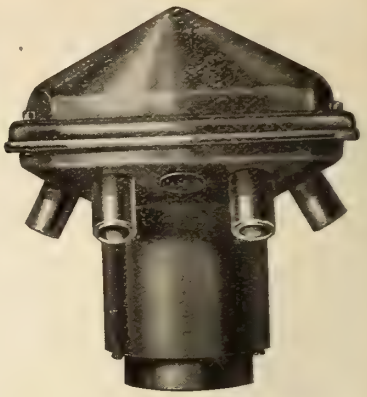
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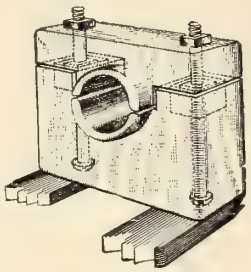
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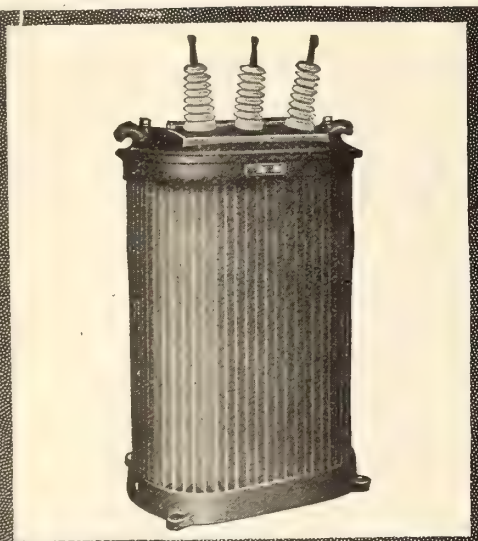
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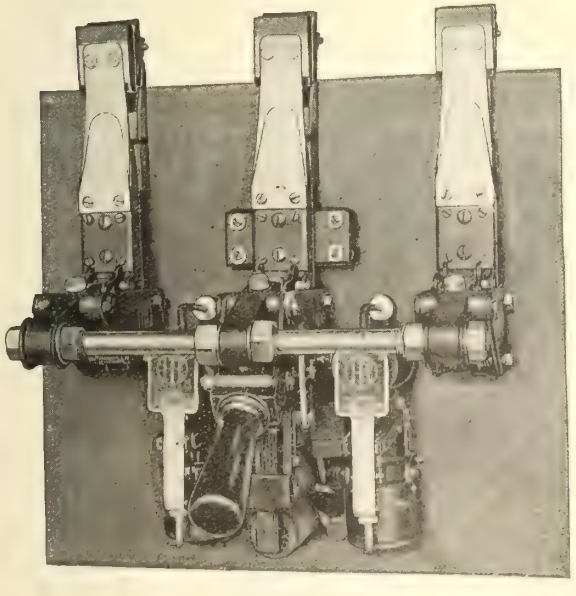
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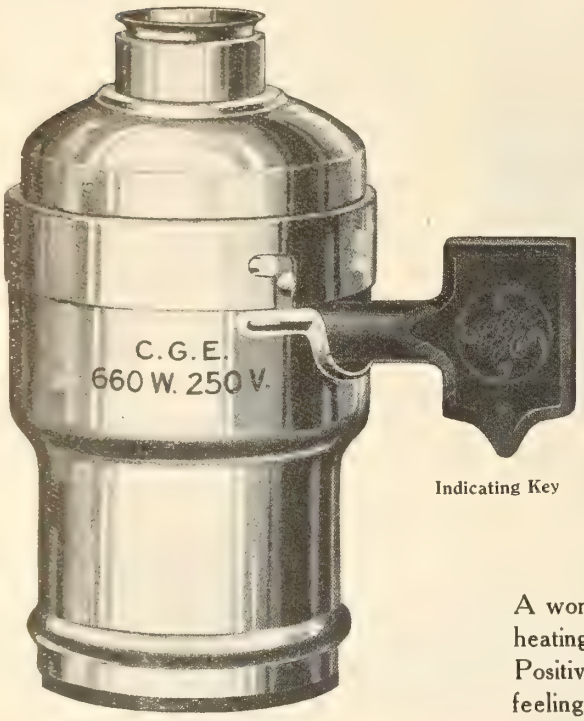
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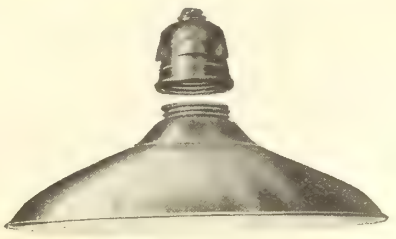
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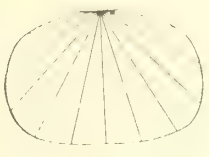
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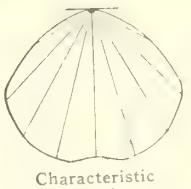
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Characteristic Angle Light Distribution



Characteristic Light Distribution

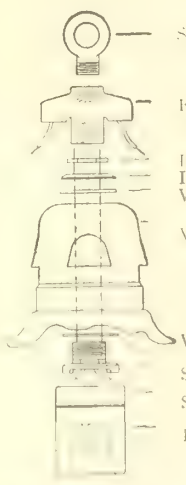


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ALLOY STEEL WORKS, LIMITED.
PER H. Armstrong
Managing-Director.

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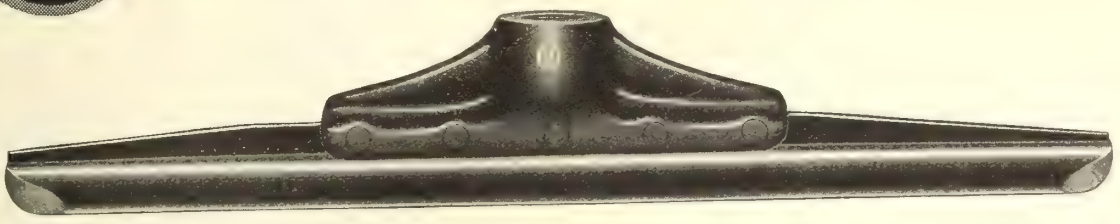
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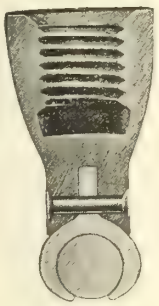
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Alternating Currents—Examples for Students and Engineers, by Prof. F. E. Austin. Second edition, Vol. I. Published in 1916. 223 pages, illustrated. Price $2.40.

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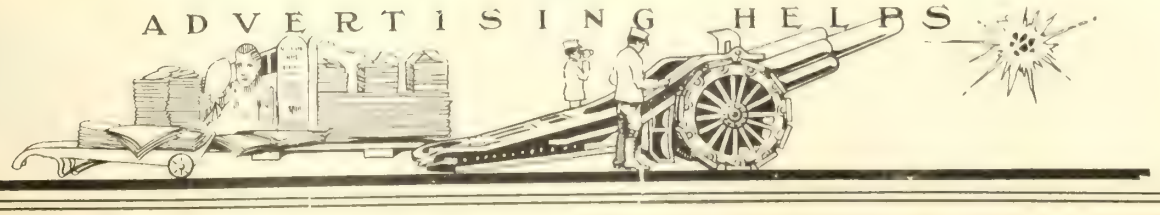
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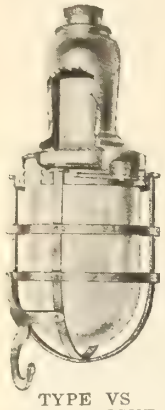
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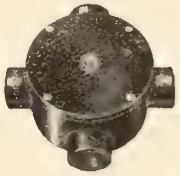
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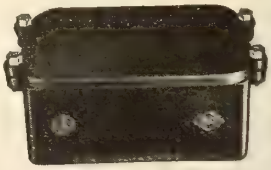
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Generation, Transmission and Application of Electricity

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Vol. 27 Toronto, February 15, 1918 No. 4

Can We Avoid a Recurrence of "Heat" Shortage?—Not Unless We Act Promptly

The people of Ontario and Quebec will now realize, as many have not done heretofore, that the fuel situation is one of the big problems calling for solution in the immediate future. So long as our coal supplies continued to come in regularly the tendency of the public has been to close their eyes to the narrow margin of safety on which we have been operating for some years. Now, however, after all classes of our citizens have felt the pinch and have realized that we are dependent for our future comfort not entirely on the friendship of the United States, but also on the ability of that country to supply our needs in the way of coal, it is reasonably certain that about the most uppermost thought in everybody's mind to-day is—what can we do? How can we prevent a repetition of our present winter discomfort and disorganization of business?

The province of Ontario and the western portion of the province of Quebec, being farthest removed from the Canadian coal fields, are naturally most vitally concerned with the solution of the coal shortage problem. It is no great strain of the imagination to foresee heavy fatalities in the future due to fuel shortage. There is comparatively little left throughout the country in the way of forests, and the "cry-out" that farmers are hauling coal out of the city when they ought to be using wood simply demonstrates that wood is not easily available. If it were otherwise, indeed, such extortion as we read of in the local press in the way of wood prices could not exist. There is evidently a shortage of wood, just as there is of coal; the shortage of labor in the country accentuates the difficulty.

To prevent real calamity, therefore, there is plainly no alternative course open to us than to utilize whatever other sources of heat supply we can lay our hands on. We have a considerable quantity of peat in these two provinces. Years ago it was demonstrated that this could be worked up into marketable form. No action has ever been taken, however, on account of the cost—it might not pay, in competition with coal at the prices then prevailing. Under the conditions of to-day these areas should be exploited at once that a supply may be available for next winter.

Then, there is the almost inexhaustible lignite supply of western Canada. Some time ago this situation was investigated by the Industrial Research Council and a recommendation made to the government that some half-million dollars be expended on a plant for briquetting this fuel into a form suitable for shipment. Cost of carriage may prohibit its shipment into the central and eastern parts of Ontario under normal conditions, but, again, cost may not always be the determining factor, and such a plant, as a safeguard, would be a fine asset to the people of Canada. Our government, therefore, in our opinion, should immediately proceed with the construction of a plant, as recommended, to be added to as experience is gained.

Finally, there is our water powers. It is a simple fact that much suffering has been avoided in the larger towns and cities of Ontario and Quebec during the past two months by the use of electric heat. An example is a case of pneumonia in an apartment house which ran entirely out of coal and where a satisfactory and instant substitute was found in a couple of electric heaters. And in thousands of homes and offices it has been used as an auxiliary. Paradoxical as it may seem, electric heaters, even where operated by steam plants, have been very real fuel conservers, for by supplying localized heat, they have made it possible to operate the main heating system of many homes at a very much lower capacity. It seems specially urgent, therefore, that every encouragement and assistance should be given to development of our water powers so that they may be available as a substitute for coal at the earliest possible moment.

We have reached a stage where "first cost" is not the prime consideration. Since we cannot do without fuel we must needs pay what it costs. In view of the experiences of the present winter the duty of our government is to safeguard us against their recurrence. Since this will take time a start should be made without further delay.

A Matter Easily Adjusted by the Power Controller

Sir Adam Beck is reported as having made the statement that one of the power generating companies at Niagara Falls is deliberately operating at less than full capacity—apparently having in mind the Electrical Development Company. Either the charge is true or it is not true.

If it is true, in view of present electric power shortage, such action is nothing short of criminal. However, there was recently appointed, by the Dominion Government, a Power Controller, whose business it is to look into just such matters. Without a shadow of a doubt he has power to investigate operating conditions in the generating plant of the Electrical Development Company. If the plant is operating under capacity he has ample power to apply a remedy. If he does not know or, knowing, has not applied the remedy, he is criminally negligent in the performance of his duty.

If what Sir Adam Beck charged is not true he should have known that it was not true and should not have laid

himself open to the implication that he was trying to extricate himself from a most difficult position by laying the blame on others.

Two New Supplementary Orders

The Power Controller has thrown a little further light on his order of January 8 by the following additional order, dated February 4, which reads as follows:

In the matter of "The War Measures Act 1914."

In the matter of the order-in-council, dated November 6, 1917, numbered P. C. 3142, and the order of January 8, 1918, issued as Power Controller appointed under the said order-in-council, and in pursuance of the powers thereby conferred.

Whereas by the said order of January 8, 1918, purchasers and consumers of electrical energy in the districts of Western Ontario served by power generated by the Niagara River were, inter alia, prohibited from using such energy for "advertising purposes or ornamental lighting."

And whereas a doubt has been raised whether such prohibition applies to window and other display lighting.

It is therefore ordered and declared that the words "advertising purposes or ornamental lighting" include the lighting of windows and other display lighting; and the said order shall be read accordingly.

Dated at Ottawa this fourth day of February, A.D. 1918.

(Sgd.) H. L. Drayton,
Power Controller.

This is supplemented by a similar order, signed by W. W. Pope, secretary of the Hydro-Electric Commission, as follows:

In the matter of the order of the Power Controller, bearing date the 8th day of January, 1918, and his declaratory order respecting the same bearing date the 4th day of February, 1918, copy of which is hereto attached, and the commission's order, bearing date January 8, 1918.

Whereas by the said order of the Hydro-Electric Power Commision of Ontario of January 8, 1918, all municipalities, commissions, companies, or persons being supplied with electrical power and energy by the commision, were, inter alia, on and after the 15th day of January, 1918, prohibited from using such energy for advertising purposes or ornamental ilghting.

And whereas a doubt has arisen as to whether such order applies to window lighting, it is therefore ordered and directed that the words "advertising purposes or ornamental lighting" includes the lighting of windows and other display lighting; and the said order shall be read accordingly, and shall take effect from and after the 5th day of February and remain in force until further notice.

Dated at Toronto, this 4th day of February, A.D. 1918.

Hydro-Electric Power Commission of Ontario,
W. W. Pope, Secretary.

This is evidently to be interpreted as meaning that all window lighting must be discontinued.

Tax on Public Utilities

In the Quebec Legislature the matter of placing a tax of 5 per cent. on the property in the streets of public utility companies was discussed a few days ago. The first idea of charging 5 per cent. on the gross receipts of such companies was abandoned. Mr. Laurendeau said the value of such property was $6,400,000. Aime Geoffrion, K.C., appeared for the Montreal Light, Heat and Power Company, and said that his company was willing to contribute to help meet the deficit, and were agreed on the principle of paying for a period of three years, but believed 5 per cent. was altogether too high, and suggested 1 per cent. He pointed to the taxes that the company was paying Montreal already; also to the fact that the real estate tax was going up, and that, under a recent judgment of the court, the utility companies had to pay not only for the share of the underground conduits that their wires occupied, but also for a proportion of the vacant space, the conduits having been made larger than necessary in order to provide for new companies. If the tax was made unduly high, the effect would have to fall upon the users of gas chiefly, and this class of people were poor.

Leon Garneau, K.C., spoke for the Bell Telephone Company. "Don't you think that the company charges enough for phones?" asked Mr. Mayrand (Dorion).

"That is a reason for not forcing the company to raise the rates by making an application to the Dominion Railway Commission," said Mr Garneau. "Heavy taxes will force the company to apply for an increase."

Alphonse Decary, K.C., appeared for the Montreal Water and Power Company, and pointed out that his clients were in a different position to the other utility companies. The company for twenty-five years had not been able to pay a single cent of dividend.

Alderman Turcot, deputy for Laurier, said the company charged 7½ per cent. for water, and Mr. Decary said that, notwithstanding charges, there was no profit, and the company was unable, because of its iron-clad contracts, to raise the price of water, and there was no reason for forcing another heavy burden upon it. The telephone and electric companies could raise their rates; the Water and Power Company could not do so.

Mr. David, of Terrebonne, asked for a suggestion as to what would be reasonable, and Mr. Decary mentioned 1 per cent. Sir Lomer Gouin closed the argument by saying that all the companies were agreed on the principle of paying this surtax to aid in the city for a period of three years, and the only question was to determine what rate should be charged. He asked Mr. Geoffrion for another quotation, and Mr. Geoffrion said he was willing to have the rate 2 per cent. The committee made it 5 per cent., except in the case of the Montreal Water and Power Company, this being fixed at 1 per cent.

Sir Lomer remarked that $300,000 among the public utilities companies would not be a great thing. The sources of revenue had to be increased. The tax was not an attack on capital, but the deficit had to be met.

Conservation of Canadian Trade

An interesting booklet, entitled "Conservation of Canadian Trade," a discussion of trade conditions after the war, the necessity for preparedness, responsibility of the government, with some valuable suggestions relating thereto, by Hon. Frederic Nicholls, president and managing director of the Canadian General Electric Company, has just been published. Senator Nicholls is chairman of a special committee of the Senate of Canada on Conservation of Canadian Trade, and the booklet is chiefly a reproduction of certain of his addresses and letters that have dealt so forcefully, in the Senate and elsewhere, with the facts concerning this important question. In the "foreword" Senator Nicholls points to the uncertainty of trade conditions after the war, which is causing grave anxiety to business men throughout Canada, and adds:

"The balance of trade is now greatly in our favor, and Canada is prosperous; in fact, so prosperous that little heed is being given to preparation for the inevitable 'slump' that will be experienced when the demand for our output diminishes and present high prices are no longer current.

"Undoubtedly much could be accomplished by the mobilization of our resources, intelligent co-operation in producing and selling, and courageous effort on the part of the government, which is well advised as to the problems to be met.

"In time of war we should prepare for peace and it will be

unfitting to our dignity as a patriotic and resourceful Dominion if prompt and decisive preparations are not made to meet the new conditions which we will soon be called upon to face."

The booklet is timely and the subject matter is presented in such a masterly fashion that it demands the earnest study of all thinking Canadians.

Splendid Lectures Before the Electric Club of Toronto

On Friday, February 1, Col. G. G. Nasmith, Ph.D., C.M.G., addressed the Electric Club of Toronto, describing the system prevailing in France for keeping the men fit. This involved, among other things, special precautionary measures regarding food and water, especially the latter, and the immediate and complete isolation of all cases of contagious disease. Among many other gratifying evidences of the efficiency of the organization of the Army Medical Department, Col. Nasmith mentioned the incredible speed with which the sick and wounded are frequently transported across the channel, the space of twenty-four hours being sufficient, in many cases, to make the transfer from the front line trenches to a comfortable hospital ward in England. Col. Nasmith's work was more particularly associated with the purification of the supply of water, for his notable achievements in which connection, it will be remembered, he received his decoration.

Professor Alfred Baker was the guest of the Club and the speaker on February 15. He spoke on a most interesting phase of after-the-war problems—the probability that Canada or England would find the national debt so burdensome as to retard commercial recuperation. By comparing the figures for population, trade, productivity and debt following previous wars, with the probably corresponding figures when the present war is over, he was able to demonstrate that the British Empire, unless the war drags on interminably, will emerge from it under much more favorable conditions than has been the case following previous wars. Regarding the probable shortage of money, which is so generally deplored, it was pointed out by Professor Baker that, like the small bullet, which owes its destructiveness to its speed, so the smaller amount of money can be made tremendously effective by rapid turnovers.

The speaker made an interesting allusion, in passing, to the probable outcome of the so-called socialistic movement. We are all socialists, more or less, and there are many practical examples at work in our midst to-day. Free schools is one example, national railways another. It is the extreme socialism that is objectionable. The problem will best be solved by utilizing the best elements in the socialistic programme. Just as republicanism has been avoided and the best form of government in the world—a limited monarchy—has been preserved to us by a recognition of the most reasonable features of democracy, so socialism in its objectionable form will be disarmed by the absorption into our existing constitution of such parts of the socialistic creed as will tend to bring closer together into a mutual understanding those elements in our citizen life which at the moment seem to be out of tune.

Activities of the American Institute

It is generally the case with the meetings of the A.I.E.E. that a non-technical subject for a lecture results in a very poorly attended meeting. This, however, was not the case on Friday, February 1st, when Prof. A. P. Coleman addressed the Toronto section. Fully fifty-five members and their friends were present, and there is no question that everybody appreciated to the full the description by Dr. Coleman of his recent trip across the South American continent. The lecture was illustrated by a wonderful series of lantern slides, reproduced from photographs and from personal water-colored sketches, for which the professor is widely famed.

On Friday, February 15th, the Section is to have the privilege of a paper by Mr. C. R. Dooley, of the Westinghouse Company, Pittsburgh, on the subject, "Training Men for Industry." As a lecturer, Mr. Dooley has few equals, and is it anticipated that this meeting will be perhaps the most successful of the whole season. It is anticipated that several gentlemen of some importance in the field of vocational education will be present to discuss this many-sided subject. A well-known Canadian engineer who is acquainted with Mr. Dooley's work, says: "Mr. Dooley has spent many years studying the technical educational problem from an aspect which it is almost impossible for a university educationalist to obtain. He has been culling the wheat from the chaff in the regular run of college graduates from nearly all American and Canadian universities. He has also developed, in connection with some of the foremost electrical engineers of the country, a system of education to supply the special needs of the Westinghouse Company

Several Canadian engineers have recently been elected to the standing committees of the A.I.E.E. Among these may be mentioned:

Mr. Wills Maclachlan (membership).
Mr. W. G. Gordon (transportation).
Mr. H. B. Dwight (transmission and distribution).
Mr. W. L. Bird (power stations).

A paper presented by Mr. Harry Baker, of the Ontario Power Company, to the Toronto Section last fall, on the subject of testing current transformers, has been accepted for publication in the Proceedings of the Institute, and will shortly be available in the form of reprints.

B. C. E. R. Activities

At the first annual meeting of the B. C. Electric Office Employees' Association of Vancouver, held January 14th, favorable reports were read of the first year's work, and the coming year is expected to be even more successful. The following officers were elected at the meeting: George Kidd (general manager), hon. president; W. G. Murrin (assistant general manager), hon. vice-president; A. E. Chambers, president; E. E. Walker, vice-president; P. Lewis, secretary; J. V. Armstrong, treasurer. The executive is: R. Carver, F. E. Reid, J. Lightbody, E. Fatkin, C. Cook, O. C. Mix, A. Forsyth, S. A. Horner, H. Findlay, P. Runcie, A. Manfield, J. Munro, R. V. Moss, W. G. Chandler, J. G. Richardson, F. Potts, E. W. Arnott, F. Fisher, John McNee and Jas. Baldwin, and Misses Reid, Gaerdes, H. Langley and Chadney, with three others to be appointed. The social club committee elected were, R. Lyon, Potts, Graham, Manfield and R. P. Fraser.

Girls for Meter Readers

The Binghamton Light, Heat & Power Company, of Binghamton, N.Y., has employed girls to read meters and deliver bills. It has been found advisable to do this on account of the general labor condition, and it is in line with the policy adopted about six months ago of employing girls in all branches of the work where it is feasible to do so, thereby releasing as many men as possible for war service.

Report on Inductive Interference

The Joint Committee on Inductive Interference, organized in December, 1912, by the California Railroad Commission and authorized to conduct an investigation of the problem of inductive interference to communication circuits by parallel power circuits has completed its work, after continuously investigating this subject for over five years, at a cost of over $100,000, borne jointly by the interested railroad, power, and communication companies and the California Railroad Commission. The investigation has obtained results of great consequence to electrical engineers in all branches of engineering, particularly to railways, power, telephone and telegraph companies, and to manufacturers of electrical apparatus. A knowledge of the work done and the results accomplished will prove indispensable also to such public utility commissions and other public authorities as have jurisdiction over the service of railways and power and communication companies. Some of the general conclusions have been published by the technical press at different times during the progress of the investigation, but practically none of the technical data have thus far been made generally available. From time to time during the course of this work technical reports have been prepared which give the data obtained from the tests and the results and conclusions derived from both the tests and the theoretical studies. Thirty of these technical reports have been selected as being of such general interest and applicability as to warrant publication. In addition to the technical reports the publication will contain final recommendations for rules for the prevention and mitigation of inductive interference and valuable historical matter concerning the investigation with general and technical discussions on the subject. The book will have a complete index and contain approximately 1,000 pages, with over 400 drawings and 30 photographs. The publication is contingent upon obtaining, in advance, a sufficient number of subscriptions to cover the actual cost of printing and binding. Anyone interested in possessing a copy should make application, immediately, to the Commission, at 833 Market Street, San Francisco, Cal.

Summary of Recommendations

The report gives the following as the seven "basic physical principles which underly the rules recommended and which should guide all efforts to prevent inductive interference:"

1. Avoidance of close proximity.
2. Elimination or suppression of harmonics.
3. Limitation of residuals.
4. Reduction of intensity of induction by favorable arrangement of conductors.
5. Neutralization of induction by coordinated transposition systems.
6. Balancing of metallic communication circuits.
7. High grade construction and care in the operation and maintenance of power circuits.

A brief summary of the recommended rules follows:

The first section, entitled: "General Provisions," provides for: (a) Applicability of the rules. Rules on operation and maintenance are to apply throughout; rules for specific parallels, to cases hereafter created; rules not limited to lines involved in a parallel, to new construction and in the event of reconstruction; (b) Co-operation; (c) Method of remedy involving the least total cost; (d) Existing parallels are to be cared for with due diligence, depending on the seriousness of their effects.

The second section consists wholly of definitions.

The third section, entitled: "Location of Lines," requires: (a) Avoidance of parallelism wherever practicable. (b) Advance notice of intention to construct a line which will create a parallel. (c) The distance between parallel lines to be made as great and as uniform as practicable. Where other remedies fail, the separation is to be increased. (d) and (e) Parallels shall be as short, and as free from discontinuities as practicable. Unnecessary crossings of highways are to be avoided.

The fourth section, entitled: "Design and Construction of Lines," (a) Requires attention to quality and workmanship to prevent failures causing interference. (b) Consideration of the configuration of power circuits is required, also the avoidance of excessive spacing, long two-wire branches from three phase lines, and single wire grounded circuits. (c) Power circuits are to be transposed throughout their lengths with barrels of 6 to 12 miles, excepting lines under 12.5 kv. with grounded neutrals, and certain lines located on private rights of way. Existing power circuits are to be transposed outside parallels hereafter created when necessary for capacitance balance, with regard to discontinuities. (d) Inside parallels an adequate transposition scheme, consisting of co-ordinated transpositions in the power and communication lines, if the latter are metallic, is to be installed, determined by co-operative study. In general, at least one barrel shall be placed in the power circuit. At highway separations from telephone lines, three mile barrels should ordinarily be employed. For parallels with telegraph lines six mile barrels are ordinarily sufficient. The most economical scheme and utilization of existing transpositions are to be considered.

The fifth section is entitled: "Design, Construction, and Arrangement of Apparatus." It provides for: (a) Quality and arrangement of apparatus to minimize interference. (b) Rotating machinery should have good wave form. Grounds on generators are to be avoided, unless the arrangements are such as to avoid unbalancing the circuit and introducing residuals. (c) Transformer exciting currents should be as low as is consistent with good practice (for most cases less than 10 per cent. at normal voltage). Grounded single phase, grounded three-wire two-phase, and grounded open-star three-phase connections are prohibited. Star connected auto transformers with grounded neutrals on three-phase lines in parallels must also have low-impedance, delta-connected windings, or other equivalent means of suppressing triple harmonic residuals. (d) Auxiliary devices to prevent distortion of the waves by rectifiers, etc., are to be installed where necessary. (e) One oil switch with poles mechanically interconnected for simultaneous operation is required between a parallel and the source of supply of the power line to operate automatically in case of abnormal conditions, except where an operator is on duty. Consideration is to be given to switching arrangements to minimize transients. Where air-break or single-pole oil switches cause trouble, oil-switches with poles interconnected are to be used. (f) Fuses are to be avoided for main lines in parallels. (g) Electrolytic lightning arresters are to be equipped to minimize their disturbing effects. (h) Indicating devices are to be provided at supply stations to give warning of abnormal conditions, and ammeters are to be installed in important neutral-ground connections. (i) Apparatus for metallic communication circuits is to be well balanced.

The sixth, and last, section, is entitled: "Operation and Maintenance," and requires: (a) All reasonable care by power and communication interests to minimize interference and, in particular: (b) Prevention of mechanical and electrical failures which would cause or promote transient disturbances and unbalanced loads. (c) Daily record of current in

(Continued on page 31)

Canadian Waters and Water Powers

Report of Commission of Conservation on Progress of Last Twelve Months' Work—B.C. Data Soon Available

We have now practically completed the preliminary survey of the water-powers of Canada. The results have been published with respect to every province except British Columbia, and the report for that province is in the printer's hands. During the past year, special efforts were made to secure detailed information with regard to electric power plants and systems throughout the Dominion. It is of great practical importance in a country where advances are so quickly made that such information should be accurate and up to date. The report which is now in progress will completely cover this branch of the subject. The members of the staff who are specially charged with the branches of the work will give their reports to the Commission in detail, and it is not necessary for me to anticipate what they will say. I purpose, however, saying a few words on the general features of the subject of hydro-electric power.

Power Progress in Ontario

The development of hydro-electric power in Canada, and especially in the provinces of Ontario and Quebec, during the last ten years has been almost incredible. At the beginning of the work of the Ontario Hydro-electric Power Commission, the late Premier, Sir James Whitney, stated that the Commission would not require so much as 10,000 h.p. At this moment, the immediate requirements of the Hydro-electric Power Commission in Ontario may be conservatively stated at 296,000 h.p., upon which demand there is a present shortage of about 70,000 h.p. A conservative estimate of the amount of power actually in use in the city of Montreal and its environs, is 225,000 h.p. The position with respect to the province of Ontario, and especially with regard to Niagara Falls, is one which should be considered with great care. At the present time, the Hydro-electric Power Commission is about 70,000 h.p. short, and it is not too much to say that this shortage will very rapidly increase. I understand that Sir Henry Drayton has reported to the Federal Government that it is not practicable to withdraw this 70,000 h.p., which is presently in demand, from the United States, to which it is now being exported, for the reason that the power is necessary for the use of plants which are producing essential war material for Great Britain and her allies. The position is, therefore, that whereas 12 or 15 years ago, it was not thought that the Hydro-electric Power Commission could make use of 10,000 h.p., and, accordingly, permits to export were more or less freely given, there is now, in round figures, an immediate demand for 300,000 h.p., and the demand cannot be satisfied.

St. Lawrence Power Situation

A situation analogous to that in which Niagara power stood fifteen years ago, now exists on the St. Lawrence River. A very large capacity for the development of power exists upon the St. Lawrence. There is a considerable development in the neighbourhood of Montreal, but the greater portion of the power still remains undeveloped. Attempts are constantly being made to fatally complicate the position with respect to St. Lawrence power by securing the privilege of private development, which will be followed by contracts for the exportation of the power developed. I understand that the Cedars Rapids company exports something like 60,000 h.p. per annum. An attempt was made some years ago to secure the privilege of developing the Long Sault power, the purpose being to export the greater portion of the power in the interest of a manufacturing corporation on the United States side of the line. This project was defeated, largely through our efforts. A similar project is now being promoted, and we are resisting it with all our energy and we trust with fair prospects of success. It is almost incredible that any responsible man should be so short-sighted as to favor this project in the face of the experience which we are now undergoing at Niagara.

International Development Proposed

Within a very few years, there will be a demand for every horse-power that can be developed on the St. Lawrence River to which Canada is entitled for use upon the Canadian side. The situation with regard to Niagara will undoubtedly be duplicated, and if we are foolish enough to allow vested interests to be created upon the other side of the line, we shall inevitably find ourselves handicapped and embarrassed as we now are with respect to Niagara power. For myself, I have no doubt at all what ought to be done with respect to the great powers dormant in the St. Lawrence River. The United States Government is not interested in the corporations that are endeavoring to get possession of the St. Lawrence powers from the other side. Neither is the Canadian Government interested in the fortunes of the gentlemen who are promoting their projects on the Canadian side. They are very few in number, and their interests are confined entirely to themselves. What the United States Government and the Canadian Government alike are interested in is that there should be a fair division of this power, that it should be developed in such a way that the neighboring and tributary population should have the use of it upon fair terms. A thorough study of the whole question inevitably leads to the conclusion that there is only one sound and satisfactory method of developing these powers, and that is by an international commission, under which the greatest and the best use of the powers will be made, the most economical development will be effected, a just and equitable division of the power will take place and the governments concerned will be able to administer the power as the Hydro-electric Power Commission administer the power of Niagara for the benefit of the people who are directly concerned in its use.

Not Public Ownership

This bold and progressive policy, if adopted by the government of Canada, will undoubtedly command the support of our people. It is not a case of advocating what is generally described as public or government ownership. We have here a peculiar set of circumstances giving rise to a problem that is capable of being solved in only one way, and common sense indicates that we should solve it in that manner.

A Word of Warning

Let me on this point add a word of warning. The institution of this Commission of Conservation arose as one of the consequences of a conference which was called by Mr. Roosevelt, then President of the United States, at Washington, some time ago. At or about that time, Mr. Roosevelt pointed out in prophetic language how the people of the United States were being threatened with a water power

unflinchingly, and to the best of his ability he projected methods of resisting the efforts which were being made to bring about that monopoly. Since that time, water-powers have been monopolized in the United States to an extent that is almost incredible. I am not at the moment able to give the exact figures, but I think that when the real figures are known, revealing the extent to which the available and easily developed water-powers of the United States have been monopolized by a very few corporations, the people of that country will suffer a shock such as they have never experienced before with regard to the transaction of any of their public business. It has become very plain within the last few years that hydro-electric power is the greatest of all factors in modern industry, and where any people endowed by nature with a vast supply of this essential element in modern manufacture, allow to be monopolized and controlled in private interests a sad awakening awaits them.

Danger of Monopoly

Fortunately in the Dominion of Canada, we got down to serious business in time, and there has been no serious monopolization of great powers. While large powers have been developed by private companies, they have served a very useful purpose, and, in most cases, their rates have been reasonable. A serious danger, however, would arise, if, at that stage of development which we are now entering, these companies were allowed to combine their interests and, by acquiring a few great powers which are easily accessible, to institute a monopoly. This would be the most serious of all mistakes and must be prevented at any cost.

With respect, specifically, to the application which is now before the Minister of Public Works for leave to dam the St. Lawrence River at the Coteau Rapids, I purpose suggesting that our Committee on Waters and Water-powers should give the matter attention and, if possible, wait upon the Minister of Public Works and the Prime Minister to emphasize the protest which has already been lodged.

Government Water Conservation Undertakings

With respect to the conservation of water-powers generally, I am able to note several enterprises of great practical importance which show that progressive policies are being carried into effect.

Ottawa River Storage

Over half a century ago, it was urged that the construction of dams on the upper Ottawa would be of great benefit to power users at the Chaudiere Falls, Ottawa. Between 1904 and 1908, detailed surveys of the proposed Georgian Bay Ship Canal via the Ottawa, Mattawa and French rivers were made. These surveys demonstrated the value of conservation dams at several points, notably at the outlets of Lake Timiskaming, Kipawa Lake and Lac des Quinze. The con-



The German Standard of Warfare

THIS remarkable illustration is the reproduction of an actual photograph taken "Somewhere in France" by an aviator, who has since been killed in action. The Germans had surrendered and were advancing under the white flag, when suddenly the front line threw themselves on the ground (note the white flag) and the entire company opened fire on the British. The original photo was very small in size and the enlargement has resulted in some blurring of the features, but nevertheless, a close study, with a magnifying glass, if one is available, reveals the brutal gloating with which the Huns are contemplating the success of their treachery. The photographer was just on the point of "snapping" the surrender, which accounts for his securing a picture that, under other conditions, would have been impossible. It is a vivid portrayal of the type of enemy our boys are up against and the unflinching courage with which they are facing death.

struction of the three dams mentioned was completed in 1915 and the water-power interests have been much benefited by their operation, particularly during the winter of 1916-17, when the low-water flow was increased by letting out the storage water.

These reservoirs can supply an additional flow of 10,000 cubic feet per second, thus increasing the total power possibilities between Mattawa and Carillon by some 400,000 h.p., while at Ottawa alone, where the water is being fully utilized, the increase is approximately 30,000 h.p.

Le Loutre Dam, St. Maurice River

The most important water conservation work thus far undertaken in Canada is that undertaken by the Quebec Government and now nearing completion at La Loutre on the St. Maurice River. It will store up the waters of the St. Maurice for the benefit of its many water-powers and will double the low-water flow.

This work had been projected for many years, as the regulation of the river is of the greatest value to the important developed water-powers at La Tuque, Grand'mere, and Shawinigan Falls, but no construction work was undertaken. After full investigation of the project, both from the physical and financial viewpoint, the Quebec Streams Commission let the contract for construction in the summer of 1915.

The work has since progressed steadily in spite of the great difficulties in transportation. It is now 80 per cent. completed and will cost about $1,500,000. When finished it will create a reservoir of 160,000 million cubic feet, forming the third largest artificial reservoir in the world, being exceeded only by the Assuan reservoir on the Nile and the Gatun Lake on the Panama Canal. From the owners of the power-sites already developed, the Commission will receive a revenue of upwards of $130,000 per annum.

Between the reservoir and the mouth of the St. Maurice there are 17 power-sites with heads of from 10 feet to 150 feet. The aggregate descent at these sites totals 800 feet, but the dams erected in developing the various sites will increase this total head to 900 feet. Under present conditions, these sites have a total capacity of approximately 350,000 theoretical horse-power, but it is estimated that some 900,000 horse-power will be available when the flow is regulated from the reservoir. At Shawinigan, Grand'mere and La Tuque alone, the three sites at present utilized on the St. Maurice, the potentiality will be raised from an aggregate of some 190,000 theoretical h.p. to over 400,000 h.p.

St. Francis River Storage

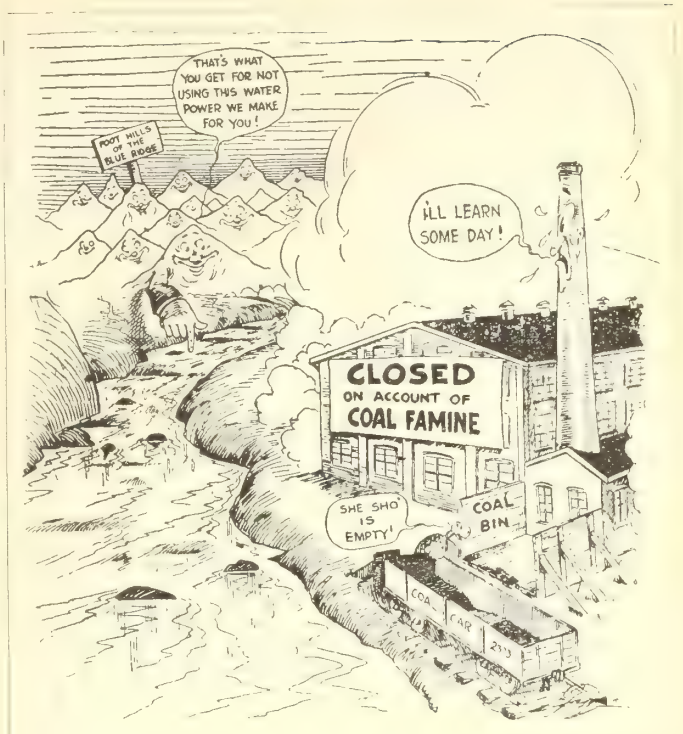
Another water storage undertaking of the Quebec Streams Commission, now nearing completion, is the St. Francis River dam at the outlet of Lake St. Francis, the lake being used as a reservoir. Contracts for the construction of the work were awarded in September, 1915. As the majority of the power-sites on the St. Francis are actually developed and, as the power-owners have suffered from insufficient water for a number of years, this work will afford much-needed relief. It is estimated that revenue from the use of the conserved water will cover all overhead charges and maintenance costs.

By raising the level of the lake 15 feet, the reservoir will have a capacity of 12,200 million cubic feet, and will increase the flow at the outlet from the natural minimum of 100 cubic feet per second, to 600 cubic feet per second. The corresponding total power increase on the river will be 21,810 h.p., of which 6,000 h.p. will immediately be absorbed by the present users, while the development of the remaining sites will be greatly facilitated.

Trent River Conservation

An extensive system of small conservation reservoirs has been established in connection with the canalization of the Trent River. These serve the double purpose of supplying the canal system and supplementing the minimum flow in the river for power purposes. There are four hydro-electric plants on this river supplying the Central Ontario system of the Ontario Hydro-electric Power Commission and these are benefitted by the regulated flow in the river. Some of these plants have a capacity as high as 8,000 h.p.

Dams have been built at the outlet of many lakes on tributary streams and the water is stored until required in the dry summer and autumn for navigation and power purposes. The control of the flow is being constantly improved by the further utilization to the fullest extent of the natural storage basins of the Trent Valley.



—From "Atlanta Constitution"

Factories closed—Ample power going to waste.

Grand River Valley

It has for some years been a matter of public knowledge that the Grand River valley in the province of Ontario is suffering more and more from a diminished flow in that river. I am not able to give an expert opinion upon the subject from an engineering standpoint, but it seems clear that the time has arrived when the Ontario Government should make a thorough scientific examination of the subject with a view to ascertaining whether conservation works can be constructed which will remedy the evil.

Directory of Natural Resources

When the Commission was organized, one of the first tasks that we set before ourselves was the preparation of an adequate and satisfactory directory of natural resources. It very soon became evident, however, that such a directory would have been fragmentary and unsatisfactory in many respects and that much information which it ought to contain was not at that time available. The researches and investigations of the past years have now put us in a position to realize the intention which has been entertained from the beginning and which, indeed, was one of the objects we had in view at the inception of the Commission's work. We shall, therefore, proceed now without further delay and undertake the preparation of such a directory and inventory of the natural resources of Canada as will satisfy the lack which has so long existed.

Electricity for Clay-Working Plants

Special Power Requirements of Clay Products Factories and Application of Motors to Meet These—Paper before C.N.C.P.A.

By Kenneth C. Berney*

Some years ago it was the general custom to drive the machinery in clay-working plants by means of steam engines. Some of the smaller plants were operated by horse-power. Now a large number of the plants, both large and small, in localities where electricity is available, are operated by electric motors.

In some plants electrical operation begins with the digging of the clay, and is used in every operation, including hauling the shale, dumping the cars, grinding, conveying, mixing, forming the product, and conveying the finished product.

We will now discuss briefly the advantages of electric motor drive over steam engine or drive from a central plant.

In contemplation of the layout of a brick, tile, or pottery plant the first point of consideration is the location. Railroad facilities, water, coal, and location of raw material are very important factors. The use of electricity, especially when supplied by central stations, simplifies the problem since the water and coal questions become of secondary importance.

Flexibility of Electric Drive

With electric drive the various departments of the plant can be located and arranged to the best advantage for operating without the limitation of arrangements imposed by central engine drive with the accompanying belt connections to the various departments.

With central steam engine drive there must be used long line shafts and belts. If it is desired to operate only one machine or department in the plant, all of this shafting and belting must be run, which means a large friction load. In such cases this power lost in friction may equal or exceed that used in doing useful work. Not only is the cost of such waste power a big item, but the wear on the belts, shafts, and bearings is considerable. Where there is fine clay dust in the air this wear is very great. The dust collects on the belts, pulleys, and works into the hanger bearings, causing belt slippage, which means decreased output, the belts must be run very tight. With individual motor drive made economically possible by using electric motors, energy is required only when useful work is being done. The control of any one machine is conveniently at the hand of the operator, and the machine can be started and stopped at will. There is no cost for power after the machine is shut down, as would occur were long lines of belting and shafting used.

In plants where there is excessive clay dust in the air electric motors can be direct connected or geared to the driven machines, doing away with belt trouble entirely.

Greater Assurance of Continuous Operation

When the various machines or departments are operated by means of individual motors there is a greater assurance of continuous operation as compared with central engine drive, in which case engine trouble means the shut-down of the whole plant. Motors maintain a practically constant speed throughout their operating range, which results in increased production over the plant driven by a single steam engine where the speed varies not only with the boiler pressure but also with the variation in load.

Electric motors can be placed wherever convenient on the ceiling, on a side wall, on the floor, or right on the machine to be driven, and the machines can be located to best serve the logical sequence of operations. The flexibility of a motor system is also of the greatest advantage, since frequent changes in the positions of the machines and additions to the equipment are often necessary. When motors are used they can be shifted with ease. All that is necessary is to run feeders to the new location. New machines can be added to any part of the plant without fear of overloading the engine, as in the case of central engine drive.

Due to the fact that motors can be applied at the closest position to the driven machines, belts, gears, etc., are reduced to a minimum. The absence of many shafts, belts, and pulleys means that the plant will be lighter and cleaner, allowing more and better work to be done.

Fuses or circuit-breakers are installed in the motor circuit as a protection against heavy overloads such as might occur if a machine became clogged with clay. In such a case the current is cut off from the motor, and it stops preventing any damage to it or the driven machine. The possibility of a shut-down due to a machine breaking is thus reduced to a minimum.

Clay-working machines may be driven by either direct current or alternating current motors. If a plant generates its own power or is right near the central station, direct current may be used for its operation. Due to the fact that direct current cannot be transmitted long distances economically and alternating current can, practically the only current supplied to-day by central stations to power users is alternating current.

Two Main Types of Motors

So we will deal with the alternating current motor as it is used almost exclusively for industrial drive. There are two main types of polyphase alternating current motors used for manufacturing purposes—the synchronous motor and the induction motor. The synchronous motor is often used to drive machines requiring, say, 200 horse-power or more where the starting conditions are light, where the starting current is not objectionable, and where only one speed of operation is desired. If overloaded more than about 50 per cent., or the voltage at the motor terminals allowed to drop more than about 10 per cent., a synchronous motor will stop.

The induction motor is used to drive such machines as required in clay-working plants, so we can confine our remarks to this type of motor.

The induction motor consists essentially of a stationary part, at either end of which is a bracket supporting a bearing. The shaft which rotates in these bearings has mounted on it a rotating member. The clearance between the rotating and stationary parts is small, being less than 1/16 in. in a 50 h.p. motor. There is no electrical connection between rotating and stationary parts, and there are few parts to get out of repair. The induction motor is the most rugged type of electric motor made.

There are two main types of polyphase induction motors —that having a squirrel cage rotor and that having a wound rotor. They are commonly called the squirrel cage motor and the wound rotor or slip-ring motor. The rotor, as the name implies, is the revolving part. The stator, or stationary part, is practically the same in both types of motor.

Squirrel-Cage Motor Generally Preferable

The squirrel cage rotor derives its name from the fact that its winding resembles in appearance the rotating wheel

* Canadian Westinghouse Co., Hamilton, Ont.

found in a squirrel's cage. The winding consists of two heavy copper or alloy rings, which are held in place by bars, usually made of copper, which span the space between the rings at regular intervals. The ends of these bars may be riveted, bolted, or welded to the two rings. The rotor of a wound rotor motor has on it a winding similar to the stationary part, consisting of many turns of insulated copper wire. The leads from the different phases of the winding are brought out to three collector rings, on which slide the carbon brushes which carry the rotor current to the external resistance which is used with this type of motor. The collector rings are often called slip rings, from which comes the name slip-ring motor. The squirrel cage rotor is more rugged than the wound rotor, and there are less parts to get out of repair. The squirrel cage rotor is practically indestructible on motors of the latest type where the rotor bars are welded to the two rings, which are called resistance rings. A squirrel cage motor is considerably cheaper to buy than a wound rotor motor. So, everything considered, the squirrel cage motor should be chosen rather than the wound rotor or slip ring motor, except in a few applications where the latter is particularly suitable.

Where it is desired to have a motor operate at a number of different speeds the wound rotor motor is used. It is very often used where the torque required to start a load is very great. This is particularly true where the power plant supplying the current is of limited capacity, as less current will be drawn from the line at start than were a squirrel cage motor used. The wound rotor motor in a clay plant is sometimes used to drive the dry pans, pug mills, and auger machines. When squirrel cage motors are used with these machines motors with large starting torque should be applied, unless there is a clutch between the motors and the machines. Wound rotor motors should not be used where there is stone dust in the air unless the collector rings are closed in, as such dust, getting between the brushes and rings, rapidly wears the collector rings. Squirrel cage motors can be supplied suitable for driving all the machines used in clay-working plants.

Characteristics of Induction Motors

A few of the characteristics of an induction motor which may be of interest are as follows:

1. It will carry a load for short periods of two to two and a half times full load without injuring the motor and without the motor stopping.

2. The speed of the motor will be practically constant from approximately 50 per cent. load to 50 per cent. overload.

3. The motor will start a load where the starting torque required is considerably greater than the running torque. The motor can be designed with a starting torque up to two and a half times the running torque where desired for heavy starting service.

4. The current taken by the motor when starting will be approximately two to five times that required when running. It depends on the load to be started.

5. If the voltage at the motor terminals drops below normal the starting torque will decrease as the square of the terminal voltage divided by the normal voltage.

In applying electric motors to clay-working machinery the following severe conditions must be kept in mind:

1. Severe starting requirements, due to the inertia of the driven machinery and to material in the machinery hardening when at rest.

2. Severe overloads, due to irregular feed of material.

3. Dusty atmosphere about plants and presence of dampness, causing collected dust on the motors to become cemented to the windings and interfering with ventilation.

4. The use of gears of large pitch and high pitch line speeds, resulting in severe vibrations.

Good service is obtained with these conditions only when careful consideration is given to the application to each individual machine. The motors in clay plants should have generous starting and running characteristics, the bearings made dust-proof, and the windings impregnated to withstand moisture. The motors should be carefully aligned with the driven machines. The feeders to the motors should be of ample size to carry the current, bearing in mind that motors which drive machines hard to start will draw much heavier currents than those driving machines easy to start. If the feeders are too small the terminal voltage will be lowered, with consequent decrease in starting torque.

To provide for the severe starting and running conditions there has been a tendency to select motors larger than necessary. The result of the low load factor caused thereby is low power factor and low efficiency of the individual motors. On account of low efficiency the cost of electric power will be greater. This cost will still be increased if there is a penalty for low power factor. The best plan is to consult the manufacturer who can supply a motor just large enough to do the required work, and with large starting torque where such is required. In case of machines hard to start, a standard squirrel motor can be used in combination with a friction cluth and the motor started without load. Friction clutches, however, are subject to wear, and should be avoided wherever possible.

Consideration must be given as to whether group or individual drive of machinery would be better. For plants with storage facilities between the various departments and the machinery scattered individual drive will usually be better, while for plants with all machinery inter-dependent and grouped group drive will be better.

The following are usual drives employed for the more common machinery found in clay plants:

1. The conveyor from the storage bin is usually belted from the motor driving the crusher or dry pan.

2. Crushers are usually belted to the motors. Motors with good starting and pull-out torques are required with all kinds of crushing machinery.

3. Dry pans are usually driven by motors geared to the dry pan shafts. The vibrations of these machines are severe, and the motor shafts should be supported by outboard bearings. An improved arrangement is to have flexible couplings between the gearing and the motors, as this prevents the transmission of vibrations to the motors to a large extent.

4. The pug mill and auger machines may be driven by motors, either belted or geared to them. Because of the large pitch of the gears of these machines considerable vibration results, and flexible couplings should be used if the motors are geared. These machines are sometimes stopped full of material, which hardens if the shut-down is of an appreciable length, and, if clutches are not provided, the starting requirements of the motors are severe. For such installations wound rotor motors are advisable.

5. The cutters, represses, elevators, and conveyors between the various machines require little power, and may be driven from the motors driving the machines upon whose operation they are dependent, or individually by small motors.

We will now briefly outline the motor drive in various kinds of modern clay-working plants. First, we will touch on the most common of all—the brick plant.

Brick Plants

There are three common forms of brick plants, depending on what kind of machinery is used to form the brick. There are the "stiff mud," the "soft mud," and the "dry mud" machines.

In case the raw material used is shale or rock, crushers or dry pans are usually used, while for soft and stiff mud, refining rolls or various kinds of pulverizers are used.

First, we will take a plant with a capacity of approxi-

mately 60,000 building bricks an eight-hour day. Both common and face brick are made from hard shale. This plant is the type where "stiff mud" machines are used, forcing the clay through dyes by an auger machine into a continuous bar, which is cut into bricks by parallel wires or by an automatic cutter. In this plant the air is drawn from the kilns containing the burned brick during the cooling period and passed through drying tunnels containing the green brick, drying the same. When it is desired to move the dried brick the hot air is shut off and the air in the tunnels is cooled by an exhaust fan. Squirrel-cage motors, two-phase, 220 volts, 60 cycle, are employed for the entire operation of the plant. The total motor capacity is 215 h.p. and the maximum demand is 130 h.p.:—

One 40 h.p.,; 850 r.p.m. Drive—Geared to and belted. Application—9 ft. dry pan. From extension shaft of dry pan to 40 ft. bucket conveyor.

One 40 h.p.; 850 r.p.m. Drive—Geared to and belted. Application—9 ft. dry pan. From extension shaft of dry pan to 40 ft. bucket conveyor and a 50 ft. x 24 in. belt conveyor.

One 40 h.p.; 850 r.p.m. Drive—Geared. Application—To an American No. 51 pug mill.

One 75 h.p.; 690 r.p.m. Drive—Geared and belted. Application—To No. 1 giant brick auger. From countershaft of brick augur to 30 ft. shaft, whch drives an 18-brick automatic cutter, three belt conveyors, a bucket conveyor, and a repress.

One 15 h.p.; 1,120 r.p.m. Drive—Belted. Application—Through countershaft to 140 in. blower; speed, 216 r.p.m., supplying draught for ovens.

Typical Drive in Common Brick Plant

Next we will take the motor drive used in a plant making common brick from soft clay which requires no screening or grinding. The daily output is 40,000 bricks. Soft mud machines, consisting of an upright receptacle with curved arms at the bottom to force the clay into press box moulds, are used. The moulds are fed automatically under a press, after being filled, and are moved forward to delivery tables.

Here one 60 h.p., 690 r.p.m., induction motor is used. It is belted by means of main shaft and countershaft to one combination pug mill and brick press, capacity 120 bricks per minute; one mould sander and one waste clay elevator to lift waste clay from brick machine to pug mill. The brick are air-dried, and cordwood is used to fire the kilns.

Lastly, we will consider the motor drive in a plant manufacturing pressed brick from a hard shale where the "dry machine" process is used. In this plant there are two separate and distinct units, each unit being driven by a 50 h.p. squirrel-cage motor. Each 50 h.p. motor is belted to a 9 ft dry pan and a brick press, as well as the necessary conveyors, cup elevators, etc. The moisture is added to the material in the dry pan, and the material is fairly dry when pressed. The kilns of this plant are fired with cordwood. Each unit is capable of turning out approximately 23,000 bricks an eight-hour day. When a large output is required both units can be run, giving an output of 46,000 bricks a day. Under this arrangement the plant is always run at high efficiency, and one unit is in reserve in case of any breakdown in the other unit.

A plant manufacturing ordinary drainage tile will have the same motor equipment as a brick plant. In fact, tile is often made in a brick plant by simply changing the dies on the auger machine so that the clay will be forced out in the form of a tube, whch is cut into the required lengths.

Sewer Pipe Plants

In a certain sewer pipe plant there is in use, or will be shortly, a total of approximately 235 h.p. in squirrel-cage induction motors. The raw material used is a weathered shale, which is brought to the plant by railroad. The shale is conveyed from the receiving platform and elevated to the storage room by means of two 5 h.p. motors, one operating the conveyor and one the elevator. The shale is first fed into a dry pan, which, along with the conveying belt and elevating cups, is driven by a 75 h.p. motor, belted to the load. From the dry pan the material is carried to the wet pans, three in number, where it is uniformly mixed. It is then conveyed by belts and elevators to the presses, where it is pressed into moulds, making the different size of sewer pipe, one length at a time. Special shapes of pipe are hand-moulded. The three wet pans and the conveyor belts are belt-driven by a 150 h.p. motor. The moulded pipe, after drying, is put in permanent kilns, which are fired by coal. The glazing of the pipe is done during the latter part of the firing.

Pottery and Ornamental Tile Plants

Here the nature of the work is such that individual motor drive offers many advantages. The use of belts and line shafting in factories of this type is especially disadvantageous on account of the fine clay powder which fills the air and collects on belts and pulleys, producing excessive belt slippage and large friction losses. The output of the plant is, in many cases, limited on account of the belt slippages. The use of individual motor drive will, in such cases, increase the output of the factory without any other increase in factory equipment, extra floor space, or labor.

In pottery and tile plants the charge, consisting of flint, feldspar and clay, is thoroughly mixed with water in a "blunger" mill. The "slip" is then sifted to remove lumps into an "agitator." Then the slip is pumped into a slip press, where the greater part of the water is pressed out. The wet clay, which is uniform in composition and free from lumps, is taken from the slip press. Up to this point the method of manufacturing pottery and ornamental tile is the same. For pottery the wet clay is pressed through a pug mill to distribute the moisture evenly and is then moulded into finished shape on "jigger" machines. For tile the wet clay is dried in racks and then passed through a crusher. After this it is ground into a fine powder in the dust mills. The fine, dry powder is then moulded into forms by presses, after which it is ready for the initial firing. The firing of the ware is practically the same in both cases. After initial firing the ware is decorated, refired, and glazed. Pottery is dipped entirely into the glaze and the tile is glazed on one side only. The ware is again fired, which completes its manufacture.

Some of the motor drives used in an ornamental tile and pottery plant are as follows. Sixty cycle squirrel-cage motors are used:

10 h.p.; 1,120 r.p.m. Drive—Geared. Application—Two double blungers.

3 h.p.; 1,120 r.p.m. Drive—Geared. Application—Sifters.

3 h.p.; 850 r.p.m. Drive—Geared. Application—Agitators.

5 h.p.; 1,120 r.p.m. Drive—Geared. Application—Slip pumps.

20 h.p.; 1,120 r.p.m. Drive—Direct connected. Application—Dust mill.

7½ h.p.; 850 r.p.m. Drive—Geared. Application—Pug mill.

15 h.p.; 690 r.p.m. Drive—Belted. Application—To several glaze machines.

An electric motor is also geared to a "grogg" pan, which crushes the broken sagars.

Porcelain Insulator Plants

Porcelain insulators which are made from "Kaolin," clay, and quartz, are manufactured much the same as pottery. The wet clay may be moulded in metal dies or on "giggers" for "petticoat" insulators, or forced through a tube machine in the shape of tubes or cylinders for tubes and bushings. The

moulded pieces are thoroughly dried, then dipped in a glaze, which has been made the desired color, and again dried. This glaze has the same coefficient of expansion as the porcelain, and has no constituents to deteriorate. The insulators are fired in kilns, which are raised to a very high temperature for a few hours and then allowed to cool down slowly. Porcelain insulators must not only stand high voltages in many cases, but at times heavy mechanical strains.

In a certain electrical porcelain insulator works located in this part of the country there is a good example of individual motor drive. The principal machines are driven by 19 squirrel-cage motors, with a total capacity of 84 h.p. The motors are belted to the driven machines.

Blunger and agitators	1—10	h.p. motor
Pug mill	1—10	"
Large centre machine	1—15	"
Small centre machine	1— 7½	"
Clay lathes	1— 2	"
Giggers	2— 1	"
Finishing machines	6— ½	"
Grinding machines	1— 2	"
Glaze mill	1— 7	"
Grogg pan	1— 7½	"
Air compressor	1— 8	"
Water pump	1— 5	"
Machine shop line shafting	1— 5	"
	19	84 h.p.

The kilns in this plant are fired with coal.

One of the points of consideration in changing over from steam to electric drive is the method of drying the product. In those plants where heat exhausted from the kilns is used for drying or where drying tunnels are heated directly by coal or gas no change is necessary.

Scientific and Industrial Research Council Holds Meeting

The Scientific and Industrial Research Council held a meeting at Ottawa at the close of last week, at which a number of important questions connected with Canadian industries were considered. A memorandum was forwarded to the government urging immediate action to make available the varied fuel resources within the boundaries of the Dominion for the use of the people of Canada in the coming year and placing the services of the Research Council at the disposal of the government to that end.

A grant was made for the purpose of carrying out an investigation on the utilization of the immense quantity of sulphite liquor which is now thrown away as a waste product by the pulp mills of Canada with a view to the establishment of certain new industries with this material as a raw product. The utilization of the waste ammoniacal liquor from Canadian gas works was also considered, this product containing large quantities of ammonia, which is of great value as a fertilizer.

Standardization of Engineering Products

The council, at the request of the Institute of Civil Engineers of Great Britain, also took steps to bring before the government and certain manufacturers of Canada the importance of Canada associating itself with the movement which has recently been organized in Great Britain, the United States, and France for combined action in connection with the standardization of various engineering products used and exported from these countries. This is a matter of great importance in connection with the building up of an export trade in this class of products by Canada at the close of the war. Connected with this the council is investigating a number of other questions which have been submitted to it dealing with post-war conditions with which our Canadian industries will be brought face to face upon the declaration of peace.

It was decided also to approach the Canadian Manufacturers' Association on the question of the development of trade organizations for the promotion of research, etc., in connection with groups of industries, such organizations having been developed with most beneficial results in Great Britain and in the United States. Co-operation along these lines is of the highest importance if Canada is to be able to hold her own in the keen competition which will develop in foreign markets with the cessation of hostilities.

The council decided to issue to the public a series of short bulletins dealing with some of the more important questions regarding the raw materials and certain manufacturing problems concerning which enquiries are being made at the present time.

Conservation of Fishery Resources

The council, in conjunction with the Biological Board of Canada, at a previous meeting, considered carefully the representations which had been made to it by the British Columbia canners' organizations and by private parties in that province on the subject of the preservation of the sockeye salmon of the Fraser River, the most important of the food fishes in British Columbia waters, and came to the conclusion that unless measures are taken very speedily the sockeye will soon be exterminated. The chief factors in this are the over-fishing of the sockeye and the obstructions that are offered to its ascent of the Fraser River to its spawning grounds in the upper reaches of that river. The first-named factor is by far the most important in this process of extermination, and it concerns international waters, through which the fish proceed from the entrance of the Strait of St. Juan de Fuca to the mouth of the Fraser River. Through the extremely large number of nets of all descriptions employed in these waters during the fishing season it is impossible for all but a minute percentage of these fish to reach their spawning grounds.

Resolution

On this subject the council passed the following resolution, which was communicated to the Minister of Marine and Fisheries:

"The Research Council and the Biological Board of Canada unite in recommending that the Dominion Government take steps to arrange a convention with the Government of the United States looking towards the appointment of an international commission which shall have the control of the salmon fisheries of the Fraser River and of all those waters through which the fish pass to reach the Fraser River, this commission to have full power to make and enforce regulations for the effective conservation and the restoration of these fisheries."

The international commission, as suggested, would have powers similar to those of the International Waterways Commission, appointed by the governments of Canada and the United States. This, in the opinion of both the Research Council and the Biological Board, is the only way in which the sockeye salmon can be preserved and the canning industry of British Columbia continued.

Report on Inductive Interference

(Continued from page 24)

grounded neutrals of important stations. (d) Transformers are not to be operated at more than specified percentages above normal voltage. (e) Care shall be exercised to avoid switching disturbances. (f) Where lightning arrester charging disturbs, it should be done in the early morning. (g) A definite procedure shall be provided for station operators during times of abnormal unbalance on power lines involved in parallels. In general, the section of a faulty line passing a parallel should be disconnected until cleared, and not energized more than once in locating the fault. To facilitate the study of such cases, accurate records are to be kept of occurrences under abnormal conditions.

Electricity as Fuel Saver in Iron and Steel Trades

By A. H. Marshall, before I. E. E.

I purpose to take as a subject of general interest, the use of electricity and its bearing on fuel saving in the iron and steel trades. With these trades the electrical industry will be associated for its greatest development in the immediate future. The war has given a great impetus to steel production, and in the period immediately after the war there seems to be every probability that the steel trade will continue to flourish. Up to quite recent times the mining of coal and ore, coking, smelting, steel making and rolling have all been more or less separate undertakings. There is every indication that the next few years will see a greater combination of interests, better application of capital and the utilization of every means to economy.

With efficient plant and means for the recovery of surplus heat, it is commercially possible to meet all the heat and power requirements of a works that is laid out complete with coke ovens, blast furnaces, steel furnaces, and mills from the combustion of the coal fed into the coke ovens, without burning any coal in producers for the steel furnaces or in boilers for any portion of the power plant. This is an ideal arrangement. It has not been attained, because even the largest undertakings, although they can be made self complete under normal operating conditions, have not been able either to safely dispense with their coal-fired heating plant, or to justify the capital expenditure necessary to make full use of their waste energy. Yet that such an economical arrangement is attainable is evident if one applies the advantages of linking up to the electrical end.

Distribution of Coal Energy

I propose to put a few figures before you to show you how the energy of the coal, as fed to the coke ovens, is distributed in the process of coking, smelting, and steel making.

In the following data in Table I., the heat available at each stage is expressed in terms of one ton of coal carbonized, and the products are those which correspond therewith. The energy values are given in kilowatt hours or kelvins, the latter being the better term, seeing that both heat and electricity are being measured.

I am dealing with the conditions of iron and steel manufacture on the North-East Coast, and have taken as a basis, one ton of ordinary Durham coking coal having a value of 12,500 B.Th.U.

One ton of coal produces 0.7 tons of coke, together with the other items shown, the heat values of which are given in the first set of figures. Now 0.7 ton of coke will smelt 0.64 ton of pig iron, and the 6,000 units of heat energy in the coke is distributed as shown in the second set of figures. Of the surplus gas, viz., 630 units at the coke ovens, and 2,160 at the blast furnaces or 2,790 in all, about 1,200 can be made use of on the open hearth converters, and 390 in reheating the steel ingots.

The heat available for conversion to electrical energy or mechanical power consists of 350 units from the tar, 650 from the slag, 300 which can be recovered as waste heat from the steel furnaces, and surplus gas to the value of 1,200 or 2,500 in all. These units of heat energy converted at a thermal efficiency of 15 per cent. yield 280 units, and this on a coal consumption of 50 tons per hour, corresponds to an output of 14,000 kw.

Let us take the case of a group of works equipped with four 70-oven batteries consuming 8,700 tons of coal per week, five blast furnaces, each making 1,100 tons of pig per week, and sufficient open hearth steel furnace capacity and rolling mill plant to convert the whole of the pig iron make into finished steel sections. Eight thousand seven hundred tons of coal per week at a steady rate of consumption is approximately 50 tons per hour.

Table I.—Distribution of Energy in 1 ton of Coal (12,500 B.Th.U. per lb.) Containing 8,200 kw.-hours

Quantity of product		B.Th.U.	Kw.-hours available for conversion to power.
Carbonizing 1 ton of Coal			
5,500 cu. ft.	Gas used on ovens	690	...
5,000 cu. ft.	Gas surplus	630	...
0.7 ton	Coke	6,000	...
0.05 ton	Coke breeze	300	...
100 lb.	Tar	470	350
2½ gallons	Benzol	110	...
		8,200	
Smelting 0.64 ton of Pig Iron:			
31,700 cu. ft.	Gas used on stoves	930	...
73,800 cu. ft.	Gas surplus	2,160	...
1 ton	Slag (sensible heat)	650	650
0.64 ton	Pig iron (sensible heat)	250	...
	Furnace reaction and loss	2,010	...
		6,000	
Utilization of Surplus Gas from Coke Ovens and Blast Furnaces:			
	Making steel (0.68 ton)	1,200	300
	Re-heating ingots (0.68 ton)	390	...
	Balance	1,200	1,200
		2,790	2,500
Conversion to Electrical or Mechanical Power:			
	Total available energy		2,500
	Less slag value		650
			1,850

Thermal efficiency 15 per cent.
1,850 × 0.15 = 280 kw.-hours per ton of coal.

On the other side of the account the power consumed at the works would be as shown in Table II. The blowing plant requirements are based on 4½ tons of air per ton of coke, equivalent to 138,000 cubic feet per ton of pig iron; theoretically it needs 1 kw. to deliver 1,600 cubic feet of free air per hour under the usual conditions of temperature and pressure which, at a blower efficiency of 72 per cent., comes out to 120 units per ton of pig iron. For the rolling mills I have taken 110 units per ton of steel.

Table II.

Kilowatts Output:	
Coal consumed per hour	50 tons
Electrical energy per ton of coal	280 kw.-hr.
Nominal output, 280 x 50	14,000 kw.
Minimum output, 14,000 x 0.6	8,400 kw.
Average output, 14,000 x 0.85	11,900 kw.

Kilowatts Load:	Units required per ton of coal	Mean kw.	Load factor	Max. kw.
Coke oven auxiliaries Blast furnace " Steel furnace "	40×50	2,000 at	0.6	3,300
Blowing plant (120×0.64)	77×50	3,800 at	0.9	4,200
Rolling mills (110×0.68)	75×50	3,700 at	0.6	6,500
		9,500		14,000
Average output units per week		11,900×168		2,000,000
Consumption " "		9,500×168		1,600,000
Surplus				400,000

The sum of the demands on this showing would be the

same as the nominal kilowatt output. One should, however, allow for a stand by supply of 40 per cent., or, say, 5,600 kw. An allowance of 15 per cent. would probably be sufficient to cover the average deficiency of the generating plant making the average output 11,900 kw., and the units per week 2,000,000, while the total consumption 9,900 × 168 = 1,600,000, leaving a surplus of 400,000 per week.

The figures given in Table I. are based on the following values, which, I think, are fairly representative:—

Gas per ton of coal coked	10,500 cu. ft.
Gas burnt on the ovens	5,500 cu. ft.
Calorific value of coke oven gas	430 B.Th.U. net.
Tar per ton of coal coked	100 lb.
Coke per ton of pig iron	22 cwt.
Gas from blast furnaces per ton of pig iron	165,000 cu. ft. 100 B.Th.U.
Calorific value of blast furnace gas	
Slag per ton of pig iron	30 cwt.
Heat required at steel furnaces per ton of ingots	6,000,000 B.Th.U.
Heat required for reheating	2,000,000 B.Th.U.

All the gas values being at normal temperature and pressure.

The coke oven results are those obtained with any well-known make of by-product regenerative oven, operated under ordinary commercial conditions. About one-half of the gas produced goes to heat the ovens, and the other half becomes available for outside use. Coke oven gas can be used for the production of power by either gas engines or boilers. It is not as suitable as producer or blast furnace gas for gas engines, because of sulphur and preignition troubles; for boiler use it gives a greater output for the same heating surface than coal. It is being largely used as fuel for steel furnaces.

The consumption of coke in the blast furnace may be taken at about 22 cwts. per ton of pig iron. The air or blast required to provide sufficient oxygen to convert the carbon (less what takes part in other reactions) into the reducing agent carbon monoxide, is about 4½ tons per ton of coke. Apart from its principal function of smelting iron, the blast furnace may be looked upon as being a large gas producer. The air for the blast is usually heated by means of brickwork stoves of the regenerative type, which makes the first call on the gas from the furnace. The stove efficiency may reach about 70 per cent. The kw. hours of heat corresponding thereto are 930, and these, added to the 2,010 units for "furnace reaction and loss," represent the quantity of heat absorbed in the smelting process.

The heating of the basic open hearth steel furnaces and mixer is commonly done by means of a simple form of gas producer, consuming about 6 cwt. of coal per ton of steel ingots, and giving off a gas having a calorific value of 130 B.Th.U. Both coke oven gas and blast furnace gas can be and are used for this purpose, the former for preference. About 6,000,000 B.Th.U. of 1,760 kw. hours per ton of steel will be required.

Waste Heat Can be Recovered

The burnt gases from the open hearth furnace leave at a temperature of about 1,100 degs. F. There is consequently a great deal of waste heat, which it is found can be recovered by fitting boilers in the flues leading to the chimney stack. About one-fourth of the heat supplied to the furnaces is available for the raising of steam.

The heat required at the soaking and reheating pits may be taken at 2,000,000 B.Th.U. per ton or 580 kw. hours.

Looking at the figures given in the table from the point of view of power production, the first available source of energy is the tar from the coke oven gas in the by-product plant. An average yield is about 100 lbs. per ton of coal carbonized, having a heat value of 500 kw. hours. Practically all metallurgical coke is now made in by-products ovens.

The 650 units available from the slag represent the sensible heat in the slag as it comes from the furnaces. So far as I know this heat has not been put to any commercial use hitherto, mainly because the gases and other sources of waste heat which are in a more usable form have not been fully exploited. It is, however, a possible source of energy.

The blast furnace gas forms by far the largest item of available heat, and its use, therefore, calls for special consideration. After the requirements of the steel plant are satisfied, there may remain 2,160 units available for power purposes. Gas engines of sizes ranging from 1,000 to 5,000 h.p. have been built for driving both blowers and generators, and a considerable number are now in use.

The whole of the blast furnace gas should be cleaned of the dust which it contains, both for heating and power purposes. Beside the frequent boiler cleanings which are necessary, the whole of the furnace plant has to stand for a day or two about every three months to permit of the flues and stoves being cleared of the great quantity of dust which accumulates. There are two systems of cleaning in vogue, one necessitating the use of a large quantity of water atomized and intimately mixed with the gas in suitable centrifugal apparatus from which the dust comes away as a sludge, and the other a filtering or dry method. Both systems rob the gas of the greater part of its sensible heat. Recently, and more particularly because of the demand for potash, consideration is now being given to an electrostatic method of dust extraction developed by Dr. Cottrell in America and used with great success.

In old-established Cleveland practice the surplus heat from the blast furnaces is converted into power by means of shell-type boilers in open settings and non-condensing steam engines at a thermal efficiency of about 5 per cent., and as a consequence there is usually little gas to spare. The advent of the exhaust steam turbine has been taken advantage of in a good many cases, improving the thermal economy by another 5 per cent. In the Middlesbrough district alone the boiler feed recovered at the power company's stations in this way exceeds 200,000,000 gallons per annum. From my own experience steam plant at the present time best fulfils the principal conditions of cost, thermal efficiency and reliability and possesses advantages over gas plant in being able to use up heat in other form than that of gas.

A 15 per cent. thermal efficiency for modern steam plant falls a great deal short of what it is possible to obtain with turbines of large size, high steam temperatures and other aids to economy, but, on the other hand, it is an advance on present practice in comparatively small stations. It is based on a boiler efficiency of 70 per cent., a steam consumption of 14 lbs. per shaft kilowatt-hour for the blowers and 12 lbs. for the 10,000 kw. sets, under ordinary commercial conditions of pressure superheat and vacuum.

Estimated Saving in Coal

There are no statistics available of the quantities of coal at present used in the several processes of iron and steel-manufacture, and I can, therefore, only make a rough estimate of the amount which would be saved with a complete system of heat recovery such as I have described. Assuming that on the average the coke oven and blast furnace gases now supply the blowing plant, the auxiliaries and one-fourth of the requirements of the rolling mills, then more coal would come into the scheme to the extent of that needed for three-quarters of the rolling mills and for the steel furnaces—an additional quantity which I would not like to put at a less figure than 11 cwt. per ton of steel, and which on last year's output would amount to about 5,500,000 tons per annum. This coal would be saved and there would still be left a surplus of energy above the works requirements.

The advantages claimed for the electrical reversing mill

have been well substantiated in practice, as is borne out by the fact that there are at the present time under construction at least seven reversing mill equipments ranging from 10,000 to 20,000 h.p. in size, capable of doing the heaviest class of work, both roughing and finishing, with outputs of over 50 tons per hour. These new mills will, together, have a capacity of well over 1,000,000 tons of steel per annum. In addition there are numerous alternating-current motor continuous mill drives being installed in sizes of from 2,000 to 10,000 h.p.

The most recent electrical development and steel works practice, and one which has received a great impetus from the war, is that of the electric furnace. It may be that the quality of steel rails, for example, produced or partly produced electrically, will be such as to command a price high enough to bear the additional cost of production. An average figure for melting and refining is 750 electrical units per ton, which may be compared with the heat absorbed by an ordinary gas-fired furnace, as shown in Table I. At this figure the mean demand would not be less than 2,600 kw., and the maximum about 3,500 kw. This addition to the mean load brings it up to 12,100, or nearly the same figure as that taken for the average output of the generating plant.

As an illustration of the scope of future electrical development, the total electrical energy to be dealt with, assuming the figures given to apply to a make of steel of 14,000,000 tons, and not counting the power taken by the blowing plant, works out at 3,300,000,000 units per annum, with a maximum load of over 600,000 kw.

Light-Weight Safety Cars the Best for All

Gives the Public Better Service, the Investor a Fair Return and the Employee Safer and Easier Working Conditions

The advent of the light-weight, quick-service safety car handled by a single operator marks a most important epoch in the development of the street railway industry. In the operation of electric railways we must recognize three factors, as follows:

1. The Public.—It is the community that gives the street railway its excuse for existence. It is their patronage that pays our bills.

2. The Investor.—It is the financier on whom we depend to furnish the capital to run our road.

3. The Employee.—It is the officers of the company—the clerks, the shopmen and the platform men— on whom the investor and the public alike depend to properly handle their investment and to sell their service.

To prove the success of the safety car we must show that the three parties referred to are benefited thereby. Likewise, the corollary is true. The benefits derived from the operation of safety cars must be divided equitably among these three parties or its success will not be assured.

To the public the safety car offers more frequent and faster service and more comfortable and safer riding. Three safety cars will displace two ordinary cars and cut the weight in two, yet provide seats for 10 per cent. more passengers. Equipped with modern motors and ball bearings on the axles, the safety car accelerates at 2½ to 3 m.p.h.p.s., or faster than the average jitneys can get started. Therefore, in actual competition with jitneys, the safety car gets away ahead of them, picks up the passengers at the next corner and is off again before the jitney can pass the car. As has been proved in jitney infested centers, the safety car has driven them off the street.

The fact that the safety car carries fewer passengers than the ordinary car simply means a reduction in the number of stops, thereby contributing to an increased schedule speed. For instance, if the schedule speed of the ordinary car were 8½ m.p.h., the safety car under the same conditions would make approximately 10½ m.p.h.—an increase of 25 per cent. The car is mounted on 24-inch wheels on an 8-foot wheelbase. Lost motion between car body and truck has been eliminated, thereby doing away with the undesirable pendulum motion of car body under rapid acceleration and braking. Furthermore, the car body is so suspended on the trucks as to provide for a natural swing or lateral movement when it takes curves or sidings. In addition to this there are a low step and cross seats, all of which contribute to the comfort of the riding public.

The safety of the passengers is cared for by automatic devices interlocked with the control of the car. Although the car is operated by one man, it is safer than a two-man car not equipped with these automatic devices. The standard safety car has straight air brakes with emergency feature. Any collision or other accident that breaks the air pipes will stop the car in emergency. Furthermore, the operator cannot leave his post unless the brakes are applied, and if he becomes incapacitated the brakes go into emergency. An emergency application may be obtained by the operator; first, by removing his hand from the controller handle (if the brakes are not already applied in service); second, by removing his foot from a foot valve (used for cutting out the emergency feature in the controller when the operator wants his left hand free to make change or issue transfers without getting an emergency application) and, third, in the usual manner by the brake valve.

An emergency application not only applies the brake with full force as quickly as air can be passed direct to the brake cylinder, but it first shuts off the power and applies sand to the rail. The use of sand on a bad rail will shorten the stop by 20 per cent. At the same time the front and rear doors are unlatched, so that they may be opened by passengers pressing against them. This is made possible by the fact that the doors are operated by air, and is one of the most important safety features of the car. Otherwise imagine the panic that would arise in case of an accident if the passengers found themselves locked in the car, as they would be if the operation of the doors were not interlocked with the control of the car.

In none of the many cities operating safety cars has the public objected to their use. On the contrary, in many ways they have evinced their approval. Whereas on a two-man car fifty per cent. of the passengers ask the conductor for change, on safety cars only 10 or 15 per cent. call for change. There is an explanation for this. Safety cars have no "riding" platform or reservoir capacity. As a result passengers unconsciously get their exact fare ready as they board the car.

On a two-man car passengers feel that the conductor is there for the sole purpose of collecting fares, and they are inclined to take their time about it. On the other hand, as passengers board a safety car they realize that the operator's primary duty is to run the car rather than collect

fares, so they feel that it is their duty not to take up any more of his time than necessary so that the car can get under way without delay. Transfers are on a rack at the side of the fare box. They are punched at the end of the run, so that no time is lost in issuing them.

The operator sits far over on the left side of the platform, thereby allowing for as much space as possible for passengers entering and leaving the car. The fact that the passengers board the car at the forward end, right at the side of the operator, enables him to "spot" his car when stopping to pick up passengers. This saves the passengers a few steps, a particularly desirable accommodation at muddy crossings. It also cuts a little time off the length of stop.

Why the Car Appeals to the Investor

To the investor, representing the capital invested in street railways, the safety car offers unusual opportunities. A 65 per cent. reduction in weight on rails means a material reduction in maintenance of track and roadway, estimated by some engineers as directly in proportion to the reduction in weight. It also means a proportionate saving in power. The saving in platform expense is more than 50 per cent., even if the operator is paid 10 per cent. more in wages than he received as a motorman. This is due to the 25 per cent. additional mileage made by the safety car. The maintenance of car and equipment is less—due to the reduction in number of wheels, motors, square feet of car surface to be cleaned and painted, etc.

Shorter headways and faster schedules encourage riding, as for instance, a 40 per cent. increase in service has occasioned a 60 per cent. increase in number of passengers. The safety car operating on a shorter headway caters to the short-haul passenger, the one that it costs the least to handle. The elimination of jitneys brought about by higher acceleration and schedule speed and more frequent service contributes largely to the increase in passenger traffic, as does also the diminution in the use of privately-owned automobiles, enhanced to some extent by war conditions. To summarize it may be said that when the cost per car-mile for operating the ordinary car is 15 cents, the cost per car-mile for the safety car is 8 cents—a saving of 7 cents. Three cents of this represents the saving in platform expense and the balance in the economies resulting from the operation of a lighter car on a faster schedule.

To the employee, particularly the platform man, the safety car also offers unusual opportunities. A greater exercise of mentality encouraged by additional responsibility is usually rewarded by a 10 per cent. increase in wages. Furthermore, the former platform man is advanced in title from a motorman or a conductor to an operator.

No man need lose his job on account of the introduction of safety cars. The change cannot be brought about rapidly enough for that. For a time, it might cause a falling off in the number of "turnovers," but during the war there is such a demand for men no objection has been raised against the safety car on account of its saving labor. On the contrary, employees like the safety car. In cities where they are being introduced there is always a long list of applications from motormen and conductors waiting to be assigned to safety-car runs.

The car is easy to operate. It is controlled by two handles, that of the controller and the brake valve. Sand may be applied in any position by pressure on the brake-valve handle. The control of the doors is also incorporated in the brake valve so that after the brake is applied the operator may open the front door by simply moving the brake-valve handle to the door-opening position. The operator is seated in a comfortable swivel chair and handles the safety car in much the same way as a chauffeur runs an automobile. The elimination of physical strains makes the operator more alert by increasing his mental efficiency. This is reflected in the reduction of accidents.

Furthermore, the ease of operation makes the safety car adaptable to the use of women operators. At this time this point is particularly worthy of consideration. As more men are called into the service, women will take their places, and it will be a long time after the war is over before they leave the various lines of endeavor that they are now entering. The economic and social fabric that is being woven by this war will not be unravelled over night.

The Car is Not an Experiment

Safety-car service is not an experiment—it is an established institution. It was on November 1, 1916, that the Summit Avenue line in Fort Worth, Tex., was changed over to safety-car operation. Since then 1,000 safety cars have been placed in service or contracted for by sixty different cities of this country. Furthermore, 98 per cent. of the one-man cars built in this country during the last two years have been the standard safety car. This fact alone should have an important bearing on the financing of new safety cars, as the question as to whether or not the proposed new cars are of a standard type is one of the first questions asked by the banker. Furthermore, it is just what the industry has been longing for—a standard car and equipment for electric street railway service.

What Can be Done Now?

What has been said so far may be good food for thought, but it does not offer immediate relief. Old equipment cannot be scrapped and replaced at once by safety cars. Furtherfore, with the government competing with private enterprises for the use of capital, there is not much of it available for the purchase of new cars and equipment. We must conserve what we have and operate it as efficiently as possible.

Undoubtedly many existing cars should be converted into safety cars and operated advantageously by one man. If the cars are too large for one man to handle during rush hours a conductor could be employed at that time. The question then arises as to what to do with him the balance of the day. Why not employ him in the shop or office? Select the work he is best fitted for and teach him how to do it and so schedule the shop and office routine as to allot certain work to these extra men. This would certainly be conserving man power to the greatest extent and would be a material benefit to the men themselves.

On the other hand, why not consider women as conductors during rush hours? There are many of them who have the time and who are willing to work on a part-time job.

The handling of factory crowds by large cars operated by one man could readily be taken care of by the prepayment method. Arrange to have the factory employees pay their fare before they enter the car. The operator could handle the additional passengers picked up en route. A car seating thirty-two to thirty-six passengers is as large a car as can be handled properly by one man when loaded to capacity.

The safety car also readily adapts itself to the zone system of fares; in fact, it is the exponent of economy and efficiency in operation—the agent that will restore confidence in the electric railway industry.

Women Conductors for St. Louis

The United Railways, St. Louis, Mo., has its first women conductors in training, special quarters having been fitted up for them, along with a rear platform and trailer entrance and vestibule in the schoolroom. A majority of the twenty-odd students are wives or relatives of employees. The training course will cover sixteen days. It is made clear that their employment was distinctly a war measure. They will be called "conductors" and receive the same pay as the men.

Agreement Reached Between City and Montreal Tramways Company

After much delay and the formulation of many schemes, an agreement has been reached respecting the conditions upon which the franchise of the Montreal Tramways Company has been extended. The provincial government several months ago appointed a commission to enquire into the whole position. Their report has been issued, and a contract signed by the commission and the company, which, however, is subject to the sanction of the local legislature.

The contract extends the franchise 35 years, and sets up a permanent tramways commission, which is to have jurisdiction over all the company's lines or any of its subsidiaries, so far as finances, operation, extension, and disputes are concerned. The three members of the commision are to be named by the Lieutenant-Governor-in-Council, and will remain in office ten years, but can be removed for cause by the government. The city and the company have also the right to appeal to the Superior Court for the removal of a member for a number of causes, including fraud, corruption, and the refusal to fulfil in good faith the duties, etc. No member can be connected with the city or any municipal corporation interested, nor shareholders in the tramways company, nor have an interest in a contract with one of the parties or interested municipalities. Appeals from the decision of the commission can be made to the Public Utilities Commission. The commission is vested with very full powers as to examining the books, files, and property of the company, and must report yearly to the city on the condition of the capital account and other accounts referring to maintenance and renewals, reserve funds, and the lowering of tariffs. The rights, privileges, and franchises possessed already by the company in the city are annulled, and any that it possesses in other municipalities or will possess will be annulled by the mere fact of these territories being annexed to the city. In such cases the annexed territories would fall under the new contract.

Conditions of the Franchise

The company is forbidden to sell, cede, transport, or lend, in whole or in part, directly or indirectly, the system or any of the rights obtained by the contract. The company guarantees the city against all claims which could be pronounced by reason of the construction, existence, maintenance, repairs, or exploiting of the tramway system. The company also undertakes not to attempt, inside or beyond the city, any enterprise, industrial or commercial, other than those shown in the contract and relative to it. Except for the arrangement of the Tramway Company with the Montreal and Southern Counties Railway Company, the company is not permitted, without the consent of the commission, to allow cars of any other company to go over the lines.

Several new lines, totalling 13 miles, are to be constructed by November 1, 1918, but the commission can extend this time, and the schedules have also been rearranged. The commission has power to order the construction of further lines from time to time and also power to order the rearrangement of the lines, poles, cables, etc. Every pole in the city, when renewed, must be of iron, and iron poles must be used on the construction of new lines. The commission will determine the speed of cars, location of transfer points, frequency of service, and so on; also the number of passengers each car may contain, the company to indicate this number on the outside of the car in large figures.

The city can compel the company to flush, sprinkle, and sweep the streets in which it has tracks, and to haul garbage, etc., at a price not to exceed 10 per cent. profit on the cost, providing that the work does not interfere with the traffic. Any contract entailing an expenditure exceeding $50,000 must be submitted to the commission within a week for its approval or disapproval.

The commission has authority to modify fares. The latter will be made uniform for the city and certain outlying districts named, to be known as the "uniform rate territory"; outside of this the company may fix different rates for local traffic and for passengers going into the uniform rate territory. The commission may vary the rates for certain hours, and fix a tariff for children and apprentices. Transfer points are to be punched on the transfers.

May Transport Freight

The company has the right to transport freight, but this is not to impede passenger traffic. The company is expressly prohibited from interfering with the formation of union among its employees. The fine for failing to comply with the contract or to refuse to comply with any order of the commission is $40 per day.

The capital value of the company is placed at $36,286,295 (Dr. L. A. Herdt was one of the valuers of the plant and assets), and the company cannot pay more than 10 per cent. per annum on this fixed capital. Six per cent. on the latter is virtually guaranteed. The amount per revenue car-mile it can spend on operation expenses will be fixed by the commission, and the establishment of various funds is ordained as follows: A fund of $500,000, to be created by $100,000 instalments in five years to pay off old debts and excesses in the operation fund beyond the amount set each year by the commission; a maintenance and renewal fund; a tolls reduction fund; and a reserve contingency fund. An annual sum of $500,000 is to be given to the city, and when everything else is provided for, including dividends of the company, the surplus is to be divided as follows: 30 per cent. to the city, 20 per cent. to the company, and 50 per cent. for the reduction of fares. Whenever the latter fund reaches $2,000,000 it must be applied to the reduction of fares.

The city has the right to expropriate the property at the end of the term of the franchise by paying for the value of the property as fixed by arbitration, with an addition of 10 per cent.

Fare Checks and Lottery of Lima Street Railway

No cash registers are used on the street cars of Lima, Peru, the company preferring to rely for its records upon serially numbered, printed paper slips somewhat similar to the transfers used in the United States. One of these is given to each passenger when his fare is paid, and he is required to show it to the inspector who boards the cars at frequent intervals to check up the conductor. Two kinds of slips are used—one for a straight ride and another for a "connection," or transfer to another line. When the latter is presented to the conductor of the connecting line, one end is torn to show that it has been cancelled, but the ticket is retained by the passenger, as in the case of the straight-ride ticket, so that he may participate in the monthly or semi-monthly drawings of the company. Different colored tickets are used on each line, and these are changed from day to day to avoid fraudulent use of the tickets. The lines about the city are divided into four sections. A prize of £30 is given to each of the three principal sections and £10 is given to the fourth. From among the numbers appearing on the tickets sold, as verified by the company's books, one is drawn for each line and the prize is awarded to the holder of that ticket. In case the prize is not claimed within four days after the drawing, all tickets sold on the day of the drawing on the line issuing the ticket that was not presented, whose last three numbers are the same as the last three of the winning ticket, are entitled to a prize of £1 each. This scheme is thought to encourage riding on the cars. In 1916 the total number of passengers carried was 28,500,000.—Commerce Reports.

The Dealer and Contractor

Improved Electrical Conditions in Province of Quebec

A new bill providing for the licensing of electrical contractors in the Province of Quebec, noted in the last issue of the Electrical News, has made possible better provision for the protection of public buildings against fire, as shown by amendments introduced in another bill now before the house.

One of the sub-sections inserted states that "no electric installation in a public building in the province for the transmission of light, motive power, or heat shall be put in or altered except by a person or under the immediate supervision of a person duly authorized and holding a license to that effect."

Another clause reads: "Every heating apparatus already installed in a building, or to be so in future, must be approved by one of the inspectors of public buildings, who shall give the proprietor of the building a certificate to that effect. This certificate must be always posted up at the place indicated by the inspector."

Still another clause states that "the chief inspector of public buildings may, with the approval of the Minister of Public Works and Labor, declare any electric installation or heating apparatus now in any public building, defective, and may order the necessary alterations to be made, and, if the proprietor does not comply with the said inspector's orders to that effect, he shall be liable to the penalties provided for elsewhere."

National Association of Contractors and Dealers

The National Association of Electrical Contractors and Dealers became a reality on January 22, and at the same time the official life of the National Electrical Contractors' Association, of which it is the logical successor, came to an end. The new association has been formed along the lines recently outlined by W. L. Goodwin and generally referred to as the Goodwin plan of reorganization, which was outlined in the issues of December 1 and December 15 of the Electrical News. One of the most important changes is the provision for extending the membership of the association so that it includes all retailers of electrical goods, whether they be department stores, hardware stores, central stations, contractor-dealers, or dealers exclusively in electrical supplies. The effect of supplies being handled by these various organizations on a different scale of prices is well known, and the results which are possible from a getting together of the various elements in the trade should be beneficial.

Opening Montreal Office

The Railway and Power Engineering Corporation, Ltd., Toronto, have opened an office in Montreal in the Power Building. Mr. J. G. Bryson, formerly of the Northern Electric Company, has been appointed Eastern manager for this corporation

Building Up Export Business

It is always a pleasure to record in these columns instances of initiative and push on the part of Canadian manufacturers in reaching out for a share of the export field. In this instance reference is made to the Duncan Electrical Company, Ltd., of 1665 St. James Street, Montreal, who have, by the application of steady persistence, coupled with experience and expert knowledge of conditions in, and requirements of, different foreign countries, built up a satisfactory trade in most parts of the world in their manufactures.

One line, originally manufactured specially for the South American market, where they have sold very large quantities, has since been shipped largely to allied and neutral Continental Europe. To meet the demands from many parts of the world for a former German product the company are now making what are known as "Tower" bolts, which they now export in large quantities.

The company recognized that, to seriously interest a foreign buyer, one essential was to talk to him in his own language, and their lists and pamphlets are, therefore, printed in English, French, Spanish, and Portuguese, and in some instances where the article is particularly interesting to that country, in Russian also.

In the beginning some doubts were expressed as to the possibility of competing successfully with the large American factories, but increased production, improved methods, and a little extra "ginger" disposed of these doubts in short order by that best of proof, "results."

The export department was suggested, organized, and developed by Mr. H. N. Howlett, and remains under his control.—Industrial Canada.

Electric Sign that Uses Fewer Lamps

An electric sign construction has been perfected by a United States firm which uses circular disc-shaped reflectors mounted within the stroke of the letter in the same position in which receptacles would ordinarily be placed. These reflectors are detachably mounted, and are adjustable to any position which leaves the sign in the shape of a regular painted sign, with the exception that the characters are studded or outlined with the adjustable circular disc reflectors. In the case of the letter "S" the receptacles are mounted in the upper and lower loops of the letter, one receptacle within each loop, making two in all. Electric bulbs are mounted in these receptacles, each electric bulb having a small cap placed over the exposed end or tip to obscure the view of the lamp from the line of vision. The circular disc reflectors are then adjusted so that they are focused to the lamp in their respective vicinity. The light rays from each lamp are projected outward in a straight line at right angles to the plane of the sign by the reflectors. The result of this arrangement is a brilliantly illuminated sign, giving an effect equal to the ordinary or old style exposed bulb sign. Operation of the sign is, also, more economical, due to fewer lamps than in the exposed bulb type

Mr. Merz on Inventions Board

In the recent radical changes in the British Admiralty, by which a complete scheme for the organization of a naval general staff has been carried into effect, the government has obtained the services of Mr. Charles H. Merz, M.I.C.E., the well-known electrical consulting engineer. He has been appointed director of experiments and research (unpaid). This involves the reorganization of the Admiralty Board of Invention and Research, and has the object at once of securing greater concentration of effort in connection with scientific research and experiment and ensuring that the distinguished scientists who are giving their assistance to the Admiralty are more constantly in and amongst the problems upon which they are advising. Mr. Merz, who has been associated with the B.I.R. since its inception, will direct and supervise all the executive arrangements in connection with the organization of scientific research and experiments. Mr. Merz will also be a member of the Central Committee of the B.I.R., under the presidency of Admiral of the Fleet Lord Fisher.

Reducing Fire Hazards

Further particulars of the bill for licensing electrical contractors, introduced by the Hon. L. A. Taschereau into the Quebec Legislature, are now available. Mr. Taschereau bases the legislation on the need for greater protection from fire, the bill applying to public buildings and including churches, schools, hotels, boarding houses with accommodation for 15 boarders, office buildings, and others. It is provided that no electric installation in the province for the transmission of light, motive power, or heat shall be put in or altered except by a person or under the immediate supervision of a person duly authorized and holding a license to that effect. The Lieutenant-Governor-in-Council may prescribe the conditions on which the license shall be granted, the fee chargeable thereon, and the conditions of installation.

Automatic Controller for Heating Appliances

For use with electric heating appliances, such as electric pads, scalp treatment pads, blankets, a Seattle manufacturer is offering the trade an automatic temperature controller which, it is said, will maintain any given temperature from 90 degrees F. to 160 degrees F., with a variation of about one degree. The controller can also be used, the maker points out, to control the temperature of electric irons, toasters, percolators, chafing dishes, etc., rated up to and including 660 watts and maintain temperatures of 250 to 800 degrees F. For use with this controller, a special pad is made for sick room service, which is 12 inches wide by 24 inches long, and can be rolled up or folded, and can be used with wet packs. The temperature controller, when employed with this pad, makes it possible to hold the temperature of the pad when rolled or folded at a constant or variable temperature.

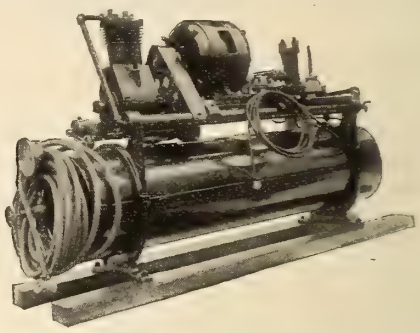
Attractive Kitchener Booklet

The Kitchener Manufacturers' Association have just published a very attractive booklet, for distribution, describing the manufacturing activities of their city. The illustrative work is wonderfully good and the booklet as a whole is a credit to the wide-awake organization that produced it. An advertisement of interest to electrical men is that of the Onward Manufacturing Company.

An electrical engineering office and storage battery station is being opened in Fredericton, N.B., by Mr. H. C. Moore, B.Sc. A line of electrical appliances and supplies will also be carried.

New Automatic Air Pressure Outfit

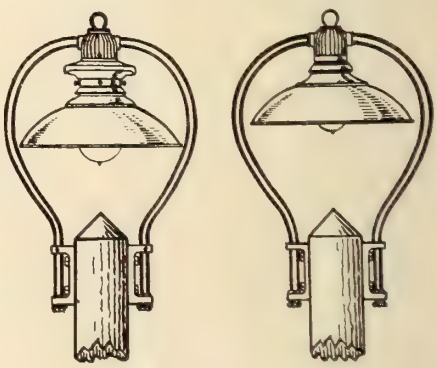
A new outfit has been developed by the M. L. Bastian Auto Engineering Works, Olney, Philadelphia, Pa., for service in garages and other places where air is required. The outfit contains a pump, motor, storage tank, pressure gauge and the necessary air and electrical connectors. The steel tank is 12 inches in diameter by 48 inches long, and is tested to a pressure of 300 pounds per square inch. The pump is a two-cylinder, air cooled design with a 1¾-inch bore and 3-inch stroke. The cast iron pistons are each equipped with eight perfection piston rings. The piston rods are bronze



with split bearings on the crank end for adjustment. The crank shaft is steel, one inch in diameter and micrometer gauged to size. Oiling is by the splash system and a sight gauge for determining the oil level is provided at the side of the pump. The outfit is equipped with a one-way valve between the tank and pump and when the pump is stopped the air is not held by check in the pump and the pump does not start against pressure. The pump is gear connected to a one-half horse-power Robbins & Myers motor, which is equipped with cord and plug for connection to a lamp socket. A rawhide pinion is provided on the motor shaft to eliminate unnecessary gear noise.

Lyre-Top Fixtures

Lyre-top fixtures designed for use in railroad yards and similar places have been designed by the Wheeler Reflector Company. The fixture on the right has a canopy with ports cast in the side, into which the arms are screwed for forming the frame of the bracket. This canopy has a copper screw

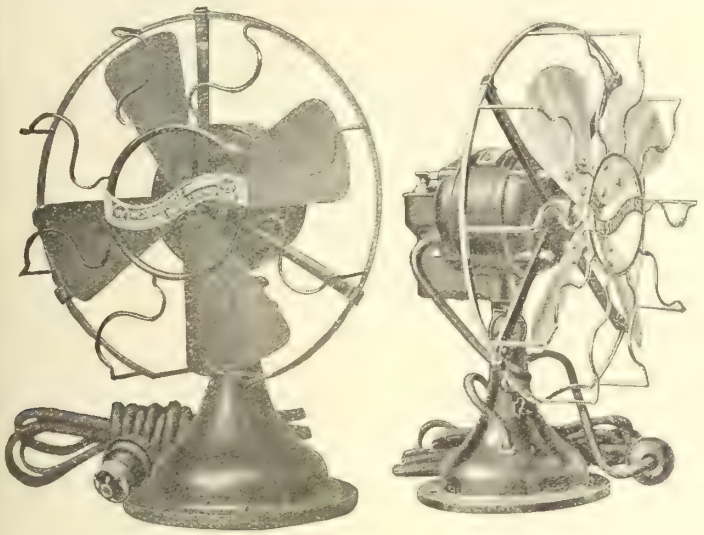


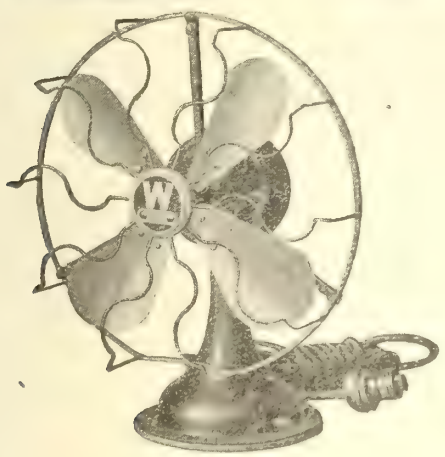
ring rolled inside, which engages the threaded collar on the reflector, making a rigid support. The lyre top shown on the left is used with a high-tension series porcelain receptacle head and the same reflector shown on the right.

The Maritime Telephone & Telegraph Company, operating in Halifax, reports that since the explosion there they have had to handle 582 order-outs. 408 of these were contained in a blanket order covering telephones that were in the heart of the devastated area; 174 were ordered out by subscribers.

Westinghouse Fans for 1918

Concentration on those models whose serviceability and popularity have been amply tested has been the aim of the 1918 changes in the line of fans made by the Westinghouse Electric and Manufacturing Company. The six-blade fans have been eliminated and some of the less popular ceiling fans have been withdrawn. All portable fans are provided with a hinge joint, to adapt them to mounting on either desk or wall. The oscillating mechanism can be adjusted for a "swing" of from 45 to 90 degrees at the rate of eight per minute, or can be locked out of service entirely. A tilt of 20 degrees from horizontal can also be had. The Whirlwind, an 8-inch fan, at a popular price, has the drawn steel construction. From it have been omitted, however, such refinements as speed control, highly polished blades, and others not necessary for durability. Current can be cut off by separating the attachment plug. The remainder of the portable line includes both oscillating and non-oscillating fans of 10, 12, and 16-





inch diameters. Ten-inch fans have zinc-plated, polished, and lacquered blades; 12 and 16-inch models have polished and lacquered brass blades. Finish of all other parts is dull black. All models are packed in substantial boxes, and include attachment plug and eight feet of cord.

Gyrating fans are furnished for either floor or ceiling mounting. The fans themselves are six-blade, 12-inch models, attached to a rotating body, which turns on a ball-bearing. One of the fan motors is geared to a mechanical drive operating on a central stationary pulley. Thus the rate of revolution does not vary with the air-reaction. Breeze at any angle from horizontal to 35 degrees below can be secured. Finish is dull black throughout, save for the blades, which are polished brass. No guards are furnished. Ceiling fans are furnished in four-blade models, of 32 and 56 inches diameter.

Industrial Lighting Reflectors

The efficient illumination of industrial plants has been made the subject of serious study for the last few years, not only from the point of view of initial economy, but having in mind also the increased value of the finished product, the lessened percentage of defective pieces, and the greater contentment of workmen relieved of nervous tension produced by eye-strain. The Wheeler Reflector Company has provided reflectors which not only show a maximum of illuminating value, but, in addition, offer designs specially adapted to the character of operation conducted under their light. Thus for general illumination of large areas group W reflectors (Fig. 1) are recommended. These can be used in lighting confined spaces also, but frequently a workman at a bench or loom or an individual machine may need a greater intensity of illumination than is essential in other parts of the plant. So a

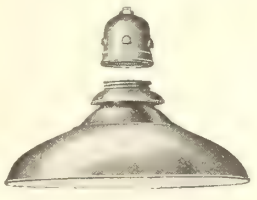


Fig. 1



Fig. 2



Fig. 3



Fig. 4

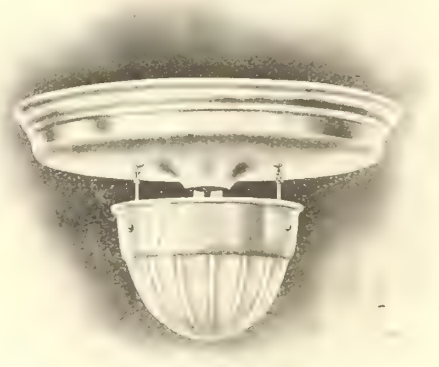


Fig 5

different type of reflector (Fig. 2) is suggested, with a smaller lamp, hung nearer the working plane, which has the effect of localizing the light. Again, the operation may be of such a character that light thrown from the side may be required to give the proper service, and group N (Fig. 3) reflectors can be used to better advantage.

Or a unit may be needed with an opaque glass globe to diffuse light from its larger surface (Fig. 4). Or offices, drafting rooms, and exhibition rooms may suggest a semi-indirect type of fixture (Fig. 5), which can be employed where the dirt and dust of a workroom is absent. A selection of the proper lighting unit, under advice from a competent engineer, may, therefore, be expected to ensure better service. The Canadian General Electric Company, Ltd., are acting as Canadian agents for the Wheeler Reflector Company.

Personals

Mr. George B. Frost, who for six years has been manager of the Smith's Falls Electric Power Company, Limited, Smith's Falls, Ont., was elected to the local hydro-electric commission at the municipal elections on January 7. At the first meeting of the commission, Mr. J. F. Montgomery, ex-mayor, was elected chairman and Mr. Frost, secretary.

Mr. J. S. Gould, who for twenty-five years was proprietor of the Citizens' Electric Company, Smith's Falls, Ont., since the purchase of that company by the Hydro has established an electrical contracting business, under the name of Alex. Baker & Company.

Mr. William Gore, of Toronto, who has been elected a member of the Canadian Society of Civil Engineers, was at one time with the Fowler Waring Cable Company, London, Eng., engaged on the design of telegraph, submarine and telephone cables and the machinery for their manufacture. He is now consulting engineer to the John verMehr Engineering Company, Toronto.

Mr. E. A. Seath, formerly with the Montreal office of the Canada Wire and Cable Company, Ltd., and the Moloney Electric Company of Canada, Ltd., has been appointed manager for the Maritime Provinces of these companies, and has opened an office at 674 Barrington Street, Halifax. He is succeeded in Montreal by Mr. Harry Riley, formerly of the Toronto office of the Canada Wire and Cable Company.

Electricity to Help Farm Production

The electrical engineering department of the Iowa State College recently planned an extensive exhibit of electric appliances and farm lighting sets for the farm and home short-course week at the college, which was held from January 28 to February 2. The farmer must help in speeding-up production. Electric lighting, electric motor-driven machines, and other electrical appliances will serve as important factors in this increased production. With these conveniences the farmer can do faster work with fewer mistakes. This is the belief of the electrical department, which concentrated every effort to make the exhibit a success.

Power Farm Machinery at O.A.C.

A short course at the Ontario Agricultural College, Guelph, concluded on February 2, and was designed to teach young men on farms how to operate power machinery and electrical equipment. About 150 enrolled in the class, under the guidance of Prof. W. H. Day and a number of experts from various machinery companies. Many farmers attended a demonstration on the closing day and learned what had been accomplished and also the benefits of electrical labor-saving devices.

Electrical Men on Engineering Institute Council

Electrical engineers are well represented among the new officers and council of The Engineering Institute of Canada, lately known as the Canadian Society of Civil Engineers. At the annual meeting, held last week, Mr. R. F. Hayward, chief engineer and general manager of the Western Canada Power Co., Vancouver, was elected vice-president, while Mr. J. M. Robertson, consulting engineer, Montreal, and Mr. John Murphy, electrical engineer, of the Department of Railways & Canals, Ottawa, were elected members of the Council.

Trade Publications

Condulets—Condulet Suggestion No. 5, by the Crouse-Hinds Company of Canada. This particular folder deals with dust-tight fittings specially designed for wiring in textile mills. These type Z G C condulets house the motor fuses and provide places and means for mounting the protected snap switches in convenient position.

Current News and Notes

Brandon, Man.

The Canada Gas and Electric Corporation, of Brandon, Man., which has been supplying power to the Brandon Municipal Railway at 2 cents per kw. h., raised the rate on February 1 to 5 cents per kw. h. As the railway was not, under the old rate, a paying utility, the increase, which will amount to $15,000 annually, will, it is hinted, necessitate a complete tie-up.

Calgary, Alta.

The Alberta Federation of Labor recently passed resolutions condemning the "one-man" street car. This should constitute a deciding factor in favor of this type of car, being an admission that they conserve labor and expenditure—an all-important factor in these present days. With the existing shortage of man-power surely the Federation of Labor need have no fear of unemployment.

Guelph, Ont.

A movement is on foot in Guelph, Ont., to develop the unused power on the Speed River. The Hydro-Electric Power Commission will make an investigation.

Kingston, Ont.

The Public Utilities Commission of Kingston, Ont., have granted a rate of 1 cent per kw. h. where current is used in heaters of 600 watts capacity or over.

Montreal, Que.

The annual statement of the Abitibi Power and Paper Company, submitted on February 11, showed that the company's earnings for the year 1917, before providing for depreciation, exhaustion of timber areas, interest, etc., were $1,323,001. After deducting fixed and other charges there remained a surplus of $341,123, which, added to the surplus of $360,925 in 1916, made a total of $702,047, out of which were paid dividends on preferred stock amounting to $70,000.

Smith's Falls, Ont.

Both the Citizens' Electric Company and the Smith's Falls Electric Power Company were taken over by the municipality on January 1, 1918, and are now operated by the Smith's Falls Hydro-Electric Commision.

Toronto, Ont.

It is stated that plans and specifications have been ordered prepared for a modern car factory to be used by the city of Toronto when the street railway is taken over in 1921. It was also decided by the Transportation Commission to order 250 cars for delivery in September, 1921.

A Toronto electrical contractor, charged with undertaking new electrical installation in a residence without having secured a permit from the electrical inspection department of the Hydro-Electric Power Commision of Ontario, was recently fined $50 and costs, or thirty days in jail.

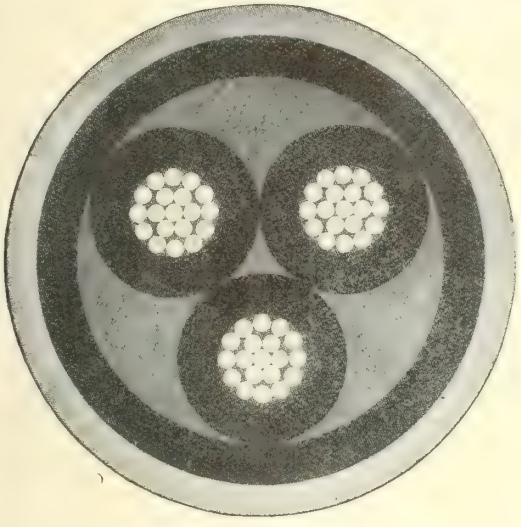
Winnipeg, Man.

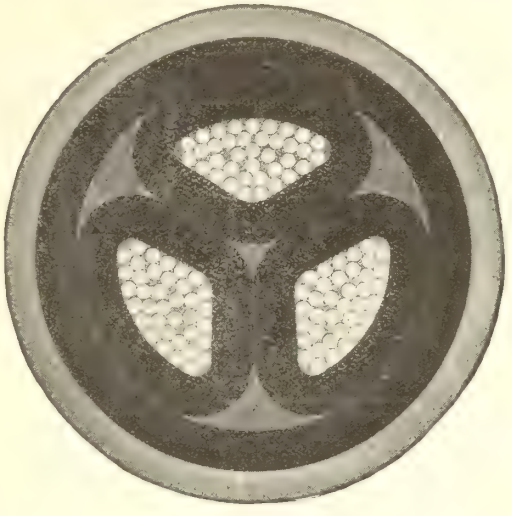
The report of the Manitoba Government telephones for the year just ended shows a deficit of $30,349.96. The revenue for the year is stated to have been $1,847,704.52, while the operating expenses totalled $1,406,940.17, showing the net telephone earnings as $440,764.35. Against this were items of $45,450.40 for salaries to men of the department in military service and $425,663.91 interest charges.

For the first time in its history the Winnipeg Street Railway Company has failed to meet its financial obligations to the city on the date fixed by charter. Five per cent. of earnings, amounting to $99,000, was due on February 1, but remains unpaid, as the company, according to its solicitor, is financially unable to meet the obligation.

PHILLIPS' CABLES

as supplied to the Toronto Hydro Electric System





These illustrations show cross sections in the original size of cables recently supplied to the T. H. E. System and reordered by them for further extensions. The specifications are as follows.—Conductors composed of 37 strands each, .082 in. diameter. Thickness of dielectric on each conductor, .210 in. Thickness in belt, .210 in. Thickness of lead sheath, .160 in. Overall diameter, 2.61 in., 250,000 C.M. Three Conductor, Paper Insulated, and plain Lead Covered Cable for 13,200 volts. We can supply you with wires and cables of any size for Power, Lighting, Telephone, Telegraph, etc.

Write us for detailed information.

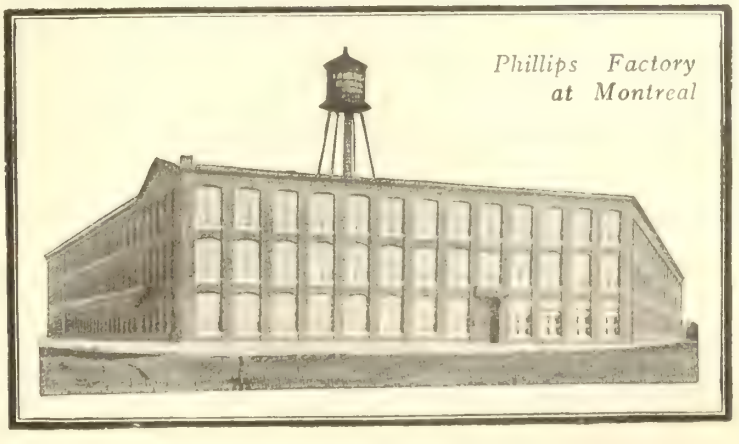
NOTE.—Specification of cable in left-hand cut: 3/0 B. and S. Three conductor. Each conductor 19 strands, each .094 in. diam. Thickness of dielectric on each conductor, .21 in. Thickness of dielectric on belt, .21 in. Thickness of lead sheath, .15 in. Overall diameter, 2.60.

Specification of cable in right-hand cut: As stated in copy.

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Head Office and Factory: MONTREAL

Branches: Toronto Winnipeg Regina Calgary Vancouver



Phillips Factory at Montreal

ELECTRICIANS

Send $1.50 for 14 Blue Prints of Motor Windings, A.C. single, two and three phase, and D.C. Winding made easy.

Elec. R. & S. Co.,
Box 233,
3-4 Sherbrooke, Que.

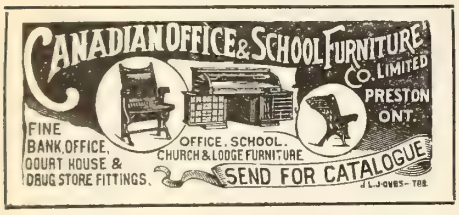
For Sale Cheap

85 Kw. Westinghouse, 250 Volt, D. C. Generator, 750 R.P.M. First class condition. Write to

The KAUFMAN RUBBER CO., Limited,
3-6 Kitchener, Ont.

Wanted—Shift Operator

for large hydro-electric plant, one who has had previous experience in large plants. Apply, giving full particulars to H. B. P., P.O. Box 1710, Montreal. 4



FOR SALE

IMMEDIATE DELIVERY

NEW and USED

MOTORS

No.	H.P.	Phase	Cycle	Volt	Speed	Maker
1	35	3	25	550	500	C.G.E.
1	20	3	25	550	710	Wstgh.
1	5	3	25	550	1400	T&H.
2	75	3	60	550	900	C.G.E.
1	30	3	60	550	900	C.G.E.
1	20	3	60	220	1700	Wstgh.
1	20	2	60	220	1200	C.G.E.
3	15	2	60	220	1120	Wstgh.
1	200	3	60	2200	514	C.G.E.
1	300	3	60	2200	600 (Synchronous).	Wstgh.

GENERATORS

No.	K.V.A.	Phase	Cycle	Volt	Speed	Maker
2	625	3	60	2200	225	C.G.E.
1	275	3	25	6600	375	Wstgh.
1	150	3	60	2200/550	600	C.G.E.
1	100	3	60	550	900	C.G.E.
1	75	3	60	2200/550	900	Wstgh.
1	50	3	60	550	1200	C.G.E.
1	25	D.C.		125	1100	Wstgh.
2	20	D.C.		125	550	Wstgh.
1	17	D.C.		125	1100	Wstgh.
1	12½	D.C.		125	1100	Wstgh.
1	5	D.C.		125	1100	Wstgh.

TRANSFORMERS

No.	K.V.A.	Phase	Cycle	Volt	Maker
2	60	1	60	10,000/2200	C.G.E.
2	15	1	60	2200/110/220	C.G.E.
2	10	1	60	2200/110/220	C.G.E.

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209 King. St. - GUELPH, ONT.

LAMPS

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Write for Lowest Cash Prices

High Efficiency Lamp Co.
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PETRIE'S LIST

of New and Used

MOTORS

for Immediate Delivery

No.	H.P.	Phase	Cycle	Volts	Speed	Maker
1	50	3	25	550	850	Westg.
1	40	3	25	550	750	C. G. E.
1	40	3	25	550	710	Westg.
1	25	3	25	2000	900	C. G. E.
1	20	3	25	550	1440	J. & M.
1	20	3	25	550	750	C. G. E.
1	7½	3	25	550	1400	Westg.
1	7½	3	25	550	720	Westg.
2	7½	3	25	550	750	C. G. E.
2	5	3	25	550	1440	Excelsior
2	4	3	25	550	1400	Excelsior
2	3	3	25	550	1400	Excelsior
1	3	3	25	550	750	C. G. E.
1	2	3	25	550	1400	Excelsior
1	2	3	25	550	750	C. G. E.
1	1	3	25	550	1450	Excelsior

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To Relieve the Shortage of Power in the Land

Hydraulic Turbo-Generator Units

450 K.W. generator, 2300 volts, 60 cycle, 3 phase, 360 R.P.M., complete with 1000 h.p. Jenckes water wheel 45′ head 300 R.P.M.

750 K.V.A. generator, 2200 volts, 60 cycle, 3 phase, 300 R.P.M. and 1780 H.P. Morgan Smith water wheel 50′ head 300 R.P.M.

300 K.W. generator, 1200 volts, 60 cycle, 2 phase, 500 R.P.M., complete with 600 H.P. Samson water wheel, 33′ head 200 R.P.M.

600 K.W. generator, 1200 volts, 60 cycle, 2 phase, 200 R.P.M. complete with 1200 H.P. Samson water wheel 33′ head 200 R.P.M.

Engine Generator Units

62½ K.W. generator, D.C. 110 v., 545 amp., 275 R.P.M., belted to 125 H.P. Robb Armstrong 13″ x 14″ engine

100 K.W. generator D.C. 250 v., 400 amp., and 200 H.P. Watertown 4 valve 16″ x 14″ engine

150 K.W. generator 2300 volts, 60 cycle, 3 phase, 450 R.P.M., belted to 300 H.P. Bellis and Morcom vertical compound engine 276 R.P.M.

350 K.W. generator, 2300 v., 60 cycle, 3 phase, 450 R.P.M., belted to 700 H.P. Robb Armstrong compound engine, 180 R.P.M.

500 K.W. generator D.C. 550 v., 910 amp., 110 R.P.M., 1000 H.P. Allis Chalmers cross compound engine 110 R.P.M.

600 K.W. generator, 2200 volts, 60 cycle, 3 phase, 150 R.P.M., 1200 H.P., Goldie & McCulloch cross compound engine, 150 R.P.M.

600 K.W. generator, 2200 volts, 60 cycle, 3 phase, 150 R.P.M., 1200 H.P., Rice & Sargent cross compound engine, 150 R.P.M.

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Armature and axle bearings
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Armature and axle straighteners
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Banding and heading machines
Car hoists
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Coil winding machines
Pinion pullers
Pit jacks
Signal or target switches
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Special Shop Working Tools.

Laclede Steel Company

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"Electroheat" Axle and Armature Shafts of all types and sizes. "Electroheat" Annealed side rods, main rods, crank pins, piston rods. All kinds of "Electroheat" Forgings, etc.

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Carbon Brushes.

Railway Track Work Company

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The Reciprocating Track-Grinder.

Westinghouse Electric and Mfg. Company

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Trolley and Catenary Construction Material.

We also handle electric passenger, freight, and express cars and locomotives of all types and descriptions.

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All engineering service without obligation. List will be continued in next issue.

Electrical Machinery and Repairs



Armatures Complete, Armatures Rewound, Armature Coils, Armature Shafts, Field Coils

Commutators New, Refilled or Assembled

Cleveland Armature Works
Cleveland, Ohio

Immediate Delivery

400—KVA. 3 phase, 60 cycle, 480 volt, 400 RPM, revolving field Westinghouse belted generator.
75—KW. 3 phase, 60 cycle, 440 volt, 900 RPM, revolving field Westinghouse generator.
2—100 HP. 110 volt, Holtzer-Cabot, D.C. motors, 550 RPM, full commutators.
50—KW. 125 volt, G.E. generator, direct connected to a 13 x 12 Ideal engine, 280 RPM, full commutator.
10—KW. 125 volt, G.E. generator, 555 RPM, full commutator, direct connected to a 18 HP. Mietz & Weiss 3 cylinder kerosene engine.
300—KW. 500 volt, D.C., G.E. generator, 400 RPM.
5—150 HP. Bigelow-Manning Boilers.
1—200 KW. G.E. 3 phase, 60 cycle, 2300 volt generator, Type ATB, Form D, speed 600, complete with switchboard
2—100 KW. G.E. 3 phase, 60 cycle, 2300 volt generators, Type ATB, Form D, complete with switchboards.

25 cycle, 220 volt motors, delivery in February, 2 to 200 HP. Write for details.

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1—18 x 30 x 16 Westinghouse Engine
1—14 x 13 Armington & Sims Engine.
1—15 x 14½ Armington & Sims Engine.
1—15 x 30 Automatic Fitchburg Engine.
1—13 x 18 Harrisburg Engine.

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The Superintendent of one of the largest electrical contracting firms writes us:
"The workmen have formed the habit of using Dossert Connectors for all kinds of connections and consider it a hardship if they are called upon to perform the tedious and laborious task of making a soldered joint with its attendant acid fumes, gasoline torch smoke and burned fingers."

Ask the man who makes the joint!

DOSSERT & CO., 242 West 41st St., NEW YORK
H. B. LOGAN, PRESIDENT
IRVING SMITH, Canadian Rep., Unity Bldg., MONTREAL

Selections from Our Stock of Motors

3 PHASE, 60 CYCLE MOTORS

Qu.	H.P.	Make	Volts	Type	Speed
2	½	G.E.NEW...	110	KT	1800
1	1	Fbks. M. ..	440	B	1200
1	2	Wstgh.	440	CS	1120
1	50	G.E. ..	220	M	960
2	3	R&M NEW.	220		1150
6	3	Wstgh. New	220	CS	1130
1	3	Cr.Wh.	220		1720
1	3	Fbks.M. ...	220	B	1200
2	2	G.E.	220	KT	900
4	3	G.E.	220	KT	1800
1	3	G.E.	220	KT	900
2	3	G.E.	220	KT	1200
2	5	G.E.NEW. .	220	KT	1800
3	5	Wstgh. New	220	CS	1130
4	5	G.E.NEW. .	220	KT	1200
2	5	Wstgh.	220	CCL	850
30	7	G.E.	550		1200
1	7½-15	Cr.Wh..	220/440		865/1735
5	7½	G.E.NEW. .	220	KT	1800
4	7½	G.E.NEW. .	220	KT	1200
6	7½	G.E.	550	KT	1800
2	7½	G.E.NEW. .	220	KT	900
2	10	G.E.NEW. .	220	KT	1800
1	10	Wstgh.	220	CCL	1700
1	10	Wstgh.	220	CS	1150
1	10	Cr.Wh. . ..	550	Q	1800
3	15	R&M	220		1150
4	15	Fbks.M.	220/440	KBV	1200
1	20	Cr.Wh..	220/440		1200
1	20	Triumph	220/440		900
2	20	Wstgh. . .	220	CS	1160
1	20	Fbks.M. . .	220	B	1200
50	20	Fbks.M.	220/440	KBV	1200
29	25	Wagner.	220/440	BP	1120
1	25	G.E.	220	M	960
2	30	Wagner NEW	220		850
1	35	Triumph	220/440		900
1	35	G.E.	220	KT	600
1	35	G.E. ...	220	KT	720
1	40	Wagner NEW.	220/440	BP	850
1	40	Fbks.M. . .	220		900
1	40	G.E.NEW .	220	KT	1200
1	50	Triumph . .	220		720
1	50	G.E.NEW. .	220	KT	900
2	50	G.E.NEW .	440	KT	900
1	50	G.E.NEW..	220	KT	1200
2	75	G.E.NEW	220/440	K	900
1	125	G.E.	2200	L	600
1	150	Wstgh. New	440	CW	695
1	200	Wstgh. . .	2200	CCL	580
1	263	G.E. Synch. with direct connected exciter.....	2200		600

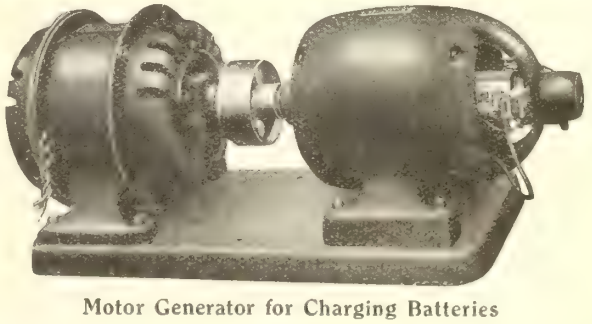
3 PHASE, 25 CYCLE MOTORS

Qu.	H.P.	Make	Volts	Type	Speed
1	5	G.E. . . .	220	KT	750
1	12½	G.E.elev.type high torque	220	KTE	750
1	15	Wstgh. . .	440	CS	730
6	15	Allis Ch. ..	220		750
1	15	Fbks.M. . .	440	B	750
7	20	Allis-Ch. ..	220		750
2	20	G.E.	440	K	750
6	25	G.E.	440	K	750
1	50	Allis-Ch. intermittent duty, sl. rg. drum controller	440		500
1	55	Wstgh.sl.rg. 30 cycles, complete. .	440		860
1	60 45 30	G.E.	440		500 375 250

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Office and Salesrooms: 141-43-45 N. Third Street.
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Motor Generator for Charging Batteries

Motor Generators and all Electrical Machinery

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Electric Fixtures Beautiful

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HAMILTON, ONT.

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Toronto—J. A. McKay, 108 Grace Street.
Agents—
Montreal—Armour Bros.—122 Board of Trade Building.
Winnipeg—Reynolds & Co.—406 Confederation Life Building.

Bastian Electric Glowing Quartz Fires



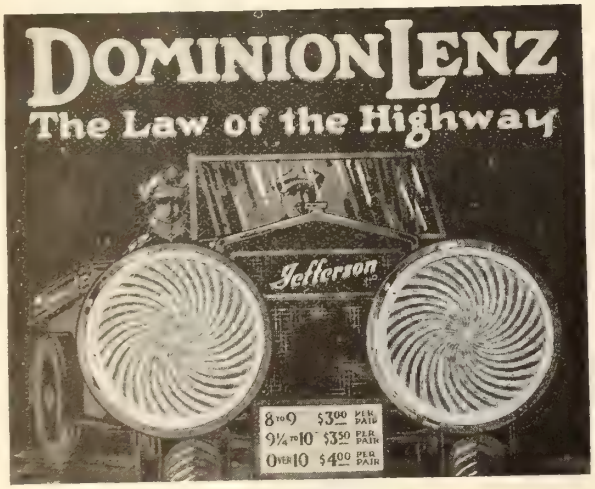
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FOR EVERY PURPOSE

Majestic Electric Heaters, Wall and Flush Types.
Despatch Electric Ovens for Bakers, Millers, Enamellers and Laboratory Purposes

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The Law of the Highway



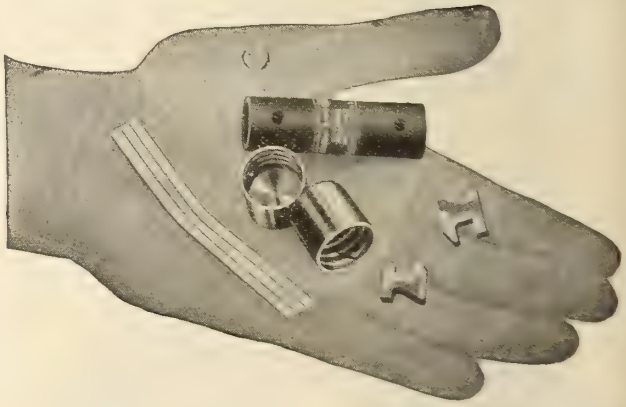
The diffused light through the *Dominion Lenz* makes night driving safe and pleasurable

All sizes carried in stock

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ROSE & O'HEARN
220 King Street West - - TORONTO



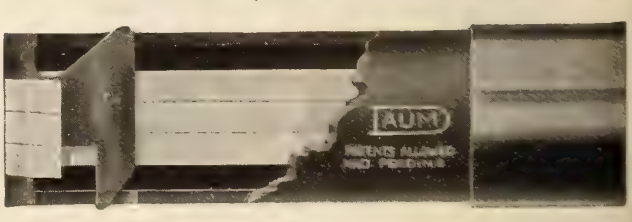
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FOR ELECTRIC LIGHT AND POWER

Always were the simplest fuses in construction on the market. The new Type "B," Form 4, has been reduced to the fewest parts—four metal parts of solid brass, a fibre shell and the fuse strip. Caps are removed by a twist of the wrist and as easily tightened, holding the fuse strip in intimate metal-to-metal contact.

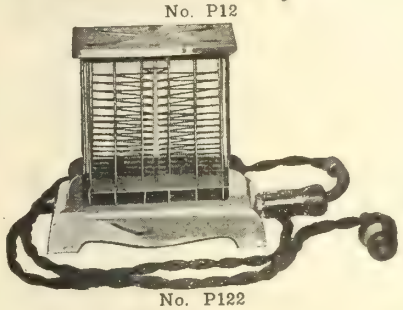
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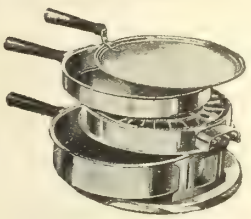




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"Premier" Electric Heating Appliances

for your 1918 requirements.

Our high class goods will appeal to your best customers and will increase your profit in larger sales.

Write for Circulars and Trade Discounts.

"Premier" appliances are manufactured exclusively by

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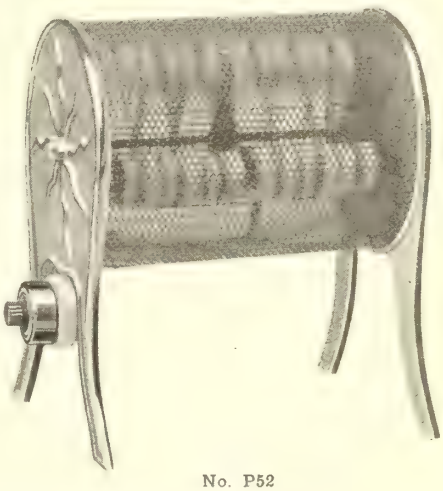
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No. S22



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Pole Type Transformers

Single and Three Phase

HIGH EFFICIENCY— LOW CORE and COPPER LOSSES

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FOR POWER, LIGHT AND TELEPHONE WORK

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Prompt Shipments from Canadian Factory.

BOSTON INSULATED WIRE & CABLE COMPANY

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Built to order

¶ With twenty-four years' experience, a modern factory, and a staff of specially skilled engineers, we are equipped to design and build transformers for special work.

¶ If you have an unusual transformer problem call on us.

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THE ANHYDROUS PHENOL RESIN COMPOUNDS

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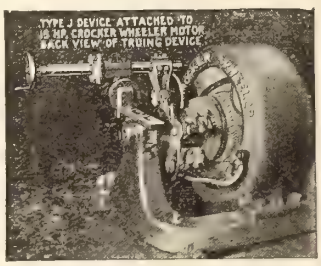
The Jordan Commutator Truing Device

Operates without removing armature. No shut down of motor or generator.

No large cuts from commutator and no unnecessary waste of copper.

No dragging of copper causing short circuits.

No portable slide-rest with the danger of the tool digging into the commutator and numerous other chances of damage to the commutator or armature which are all overcome with this machine.



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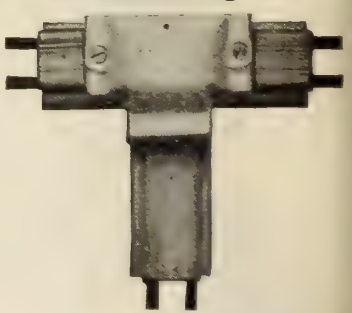
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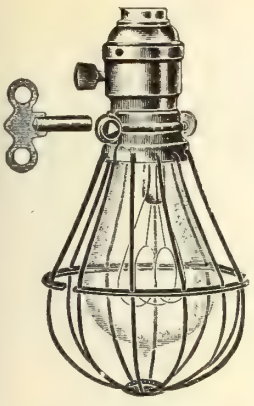
A real time saver which means a Money Saver, making the best class of work.

It is not necessary to have the ends of the capping straight as the cover of the Tapon overlaps the capping, thereby covering any bad ends of capping.



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Jordan Tapons may be secured from your nearest Electrical Supply House.



Safeguarding the Lamp

From Theft or Breakage LOXON Does It!

One turn of the key and the lamp can't come out. Loxon, the lamp guard, is popular all over America. It sells at a single price at a single glance.

Many other electrical specialties which will make money for you. Get in touch with us. Illustrated price lists free.

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Shot—High and low carbon
Ingots—Two sizes, 25 lbs., 50 lbs.
ELECTROLYTIC NICKEL—99.80%

Prime Metals for the Manufacture of Nickel Steel, German Silver, Anodes and all remelting purposes. Our Nickel is produced as Rods, Sheets, Strip Stock, Wire and Tubes

MONEL METAL
Reg. U. S. Pat. Off.

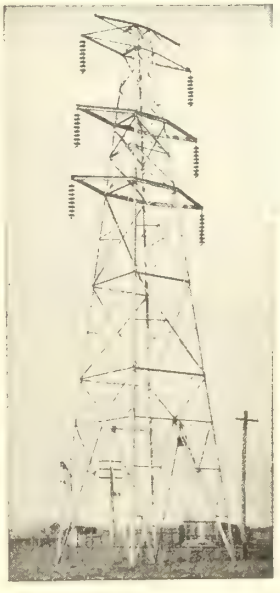
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Manufactured forms are Rods, Flats, Castings, Tubes, Sheets, Strip Stock and Wire.

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Standard Tower of the Hydro Electric Power Commission of Ontario

The modern means of supporting overhead wires.

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We shall be pleased to furnish designs and estimates upon request.

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Structural Steel of all Kinds

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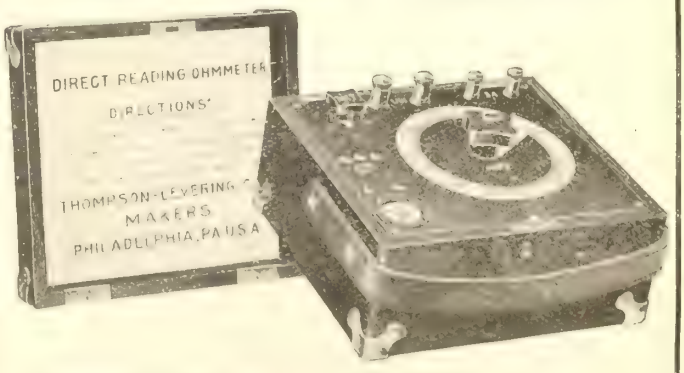
of your pole lines by using our

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They last longer, look better, and cost less to erect than any other kind. Treated with Carbolineum or Creosote they make you a big saving. Full information without any obligation from our nearest office.

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Switches, Switchboards, Panels and Steel Boxes

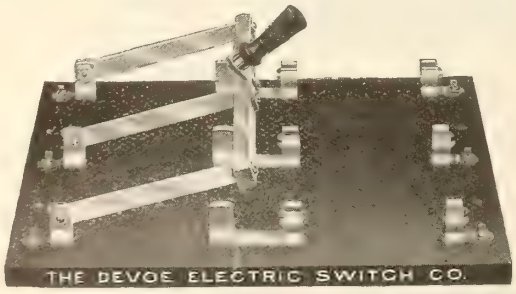
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Knockouts are easily removed — no hammering the box out of shape—and painted with a special compound and air dried. The covers lap over on all four sides, making these boxes absolutely rust proof.

Hundreds of Contractors are using them. You'll never know how good they are until you try them, and now's the time to do it.

We are equipped to build special switches to any specification. As specialists in this line we are able to produce all kinds of switches at reasonable prices.



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Every customer satisfied — profits sure—a good line to handle for winning the good-will of motorists and users of engines.

Get the "Reflex" Agency.

Write for full particulars.

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The only reliable protection against the action of acid and chemical fumes.

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Rustproof elastic paint. Superior to Graphite or Red Lead. Defies all climatic conditions.

"DRIOROL"
Oil-proof Enamel. Dries quickly over greasy and oily surfaces. Not affected by lubricating or transformer oils.

"ARMOUR"
Fire-resisting paint, or colorless solution.

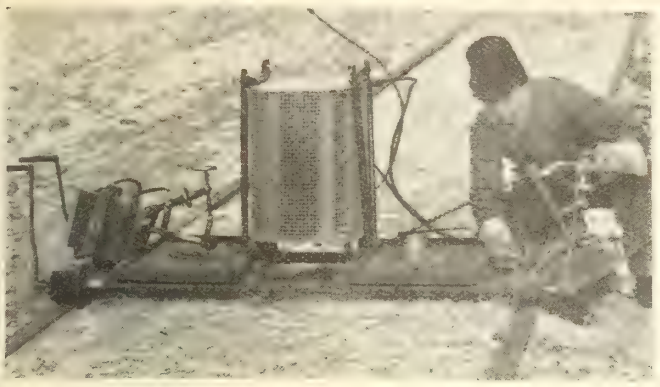
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Black, quick air-drying insulating composition. Also supplied for stoving, and as a solid insulating compound.

"SHAYDOLITE"
for coloring electric lamps. Used in the Royal Navy. Weatherproof. Dries rapidly.

"ARMABRON"
Bitumen protective paint, elastic, acid-resisting, weatherproof.

Made in London, England, by
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SPIELMANN AGENCIES, (Regd.)
Dealers in Electrical Specialties
Read Bldg., St. Alexander St. MONTREAL



Portable Welder

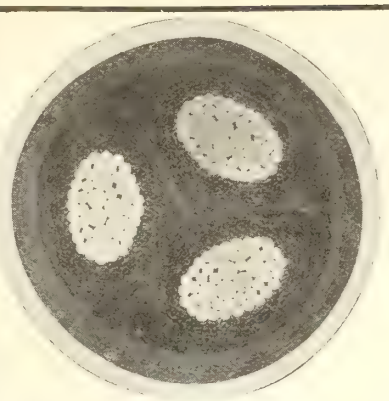
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ERICO WELDED BONDS

It can be easily lifted from the track by two men. There are no rotating parts and no flame or arc strikes bond or rail.

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Hamilton, Ontario
Montreal Hamilton Toronto Seattle

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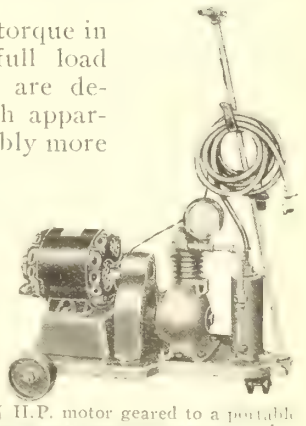
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Repulsion Start Induction

SINGLE PHASE MOTORS

which possess a starting torque in excess of three times full load torque. They therefore are desirable for operating such apparatus as requires considerably more torque to start it than to keep it in motion and especially for such as is located in cold places and is controlled automatically or from a distance.

THEY — KEEP — A — RUNNING



¼ H.P. motor geared to a portable air compressor for garage service.

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(Continued on page 54)

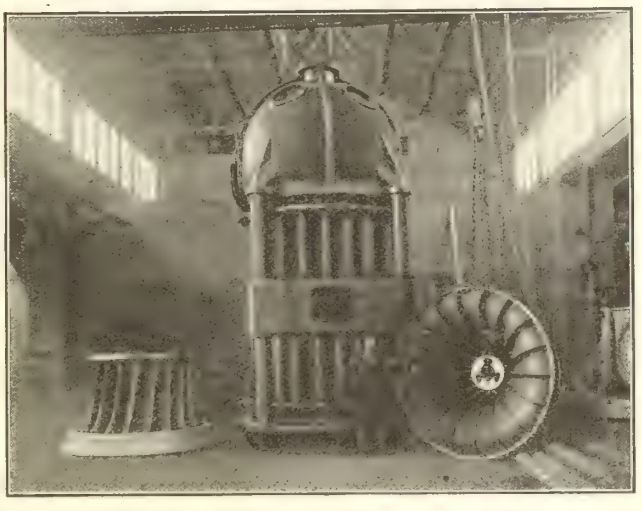
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Northern Electric Company

(Continued on Page 56)

SQUARE D

STEEL ENCLOSED MOTOR STARTING SWITCHES

TO-DAY'S industry will influence the nature of our future peace. Maximum production is a vital necessity. Conditions demand the best in mechanical equipment. Machinery must be kept busy—shut-downs be avoided.

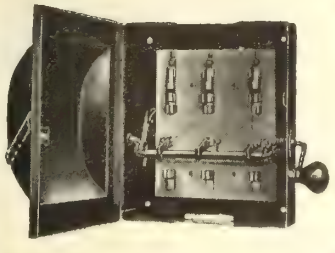
The Square D trade mark identifies the original Safety Switch, Square D Motor Starting Switches, because of superior mechanical design and substantial construction, not only make your machines safe-starting but also help you to avoid costly interruptions to service.

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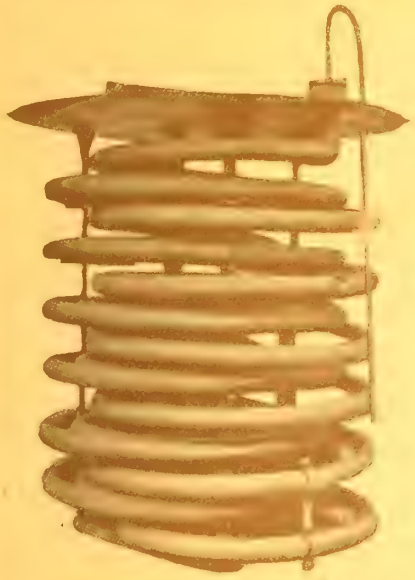
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25 Cycles.

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VOL. XXVII. NO. 5 TORONTO, MAR. 1, 1916.

Electrical News

Generation, Transmission and Application of Electricity



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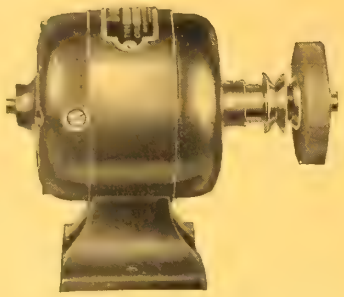
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Northern Electric
"DUMORE" UTILITY MOTORS



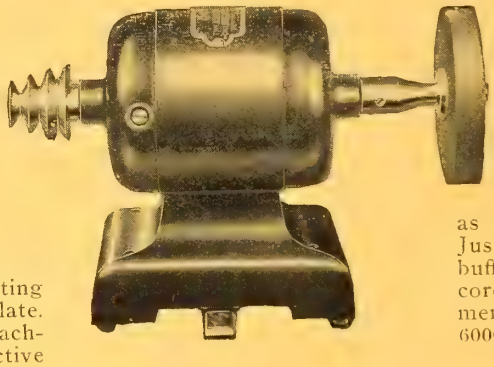
——are a boon to Housewives, and go a long way towards helping solve the servant problem by furnishing sufficient power to do light chores. "DUMORE" Utility Motors are small in size but capable of long, hard service in driving many domestic appliances, or with attachments for polishing silverware, cleaning cutlery, sharpening knives, etc., etc.

TYPE "A" 1 25 H.P.

Built to meet the demand for a light, compact power unit. Finished in black enamel. Equipped with 3 ft. of cord and attachment plug, wheel arbor and emery wheel. Wheel arbor nickel plated. Speed 2000 to 9000 R.P.M.

TYPE "B" 1 25 H.P.

The Type B Motor is the same as the Type A illustrated above, excepting that it is finished in all nickel plate. Equipped with 3 ft. of cord and attachment plug. Makes a very attractive looking motor for any use.



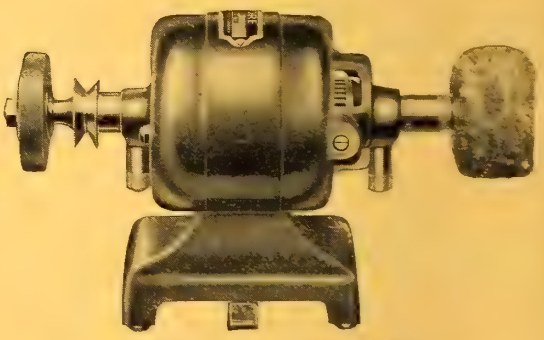
Type "C" 1 16 H.P.

Light and powerful. Always ready for use, and is as near trouble proof as it is possible to make a motor. Equipped regularly with 3-step pulley on one end of the motor shaft and a wheel arbor on the other, together with emery wheel. The Type "C" can be equipped the same as the Type "D" motor if so ordered. Just the motor for light polishing and buffing work. Equipped with 8 ft. of cord and attachment plug, Cutler-Hammer 3-speed Rheostat. Speeds 2000-6000-8000 R.P.M.

Practical—Efficient—Economical

For Jewelers, Dentists, Hotels and Restaurants the "DUMORE" Utility Motor will be found indispensable in a great many ways. Furnished in three sizes —"A"—1/25 H.P.; "C"—1/16 H.P., and "D"—1/8 H.P. For the benefit of the trade we have undertaken to advertise these famous "DUMORE" small motors to the public through the Daily Papers from coast to coast, and it will be to your distinct advantage to carry this line in stock for demonstration when called upon to do so.

For full particulars, prices and attractive literature, write our nearest house.



TYPE "D" 1 8 H.P.

The Type "D" Motor is one of the most popular of stock sizes. Is especially adapted for jewelers' and dentists' work. Equipped with 8 ft. cord and attachment plug. Cutler-Hammer 3-speed Rheostat in the base. Shaft ends are tapered. Ritter chucks and wheel arbors can be used on this motor. Speeds 2000-6000-8000 R.P.M.

Northern Electric Company
LIMITED

Montreal	Toronto	Regina
Halifax	London	Calgary
Ottawa	Winnipeg	Vancouver



Mr. Dealer—

Prepare for the House-Cleaning Season

EUREKA Electric Vacuum Cleaner

was awarded the Grand Prize by a Jury of Electrical Experts at the Panama Pacific International Exposition, San Francisco. EUREKA, the one best in competition with eighteen other makes.



EUREKA cleans mattresses perfectly.

THE EUREKA ELECTRIC VACUUM CLEANER excels in all requirements of high grade suction and great air displacement. Removes the maximum of dirt from the surface in the fabric, underneath carpets and rugs, without rubbing.



Cleaning portieres

THE EUREKA ELECTRIC VACUUM CLEANER possesses exclusive and convenient features, such as the "Eureka" Handle Lock, "Eureka" Button Switch and "Eureka" hose attachment, that are not to be found in any other similar make of Vacuum cleaner.

The nozzle, motor and blower frames are made in aluminum alloy of high grade finish. The compactness and lightness of the Eureka makes it most convenient to use.

THE EUREKA ELECTRIC VACUUM CLEANER comes complete with a handy set of attachments for cleaning portieres, upholstery, etc.



Handle Lock

New EUREKA Locking Handle —very durable and efficient, (patent applied for).



Convenient button switch and cord protecting knob, (patent applied for).



Cleaning under beds.

Write our nearest house for attractive literature and prices.

Northern Electric Company

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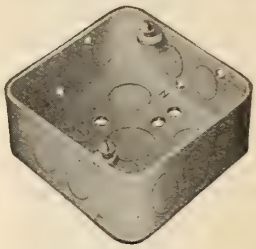
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National



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A complete line—A box for every purpose—A purpose for every box. Stamped from the highest grade steel. Designed and manufactured under the direct supervision of the foremost expert in the country. Easy knockouts, riveted cover lugs and other distinctive features.

Write for complete descriptive catalogue.

National Metal Molding Co.

Manufacturers of
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BOSTON NEW YORK CHICAGO ATLANTA DENVER DETROIT BUFFALO PORTLAND SEATTLE
SAN FRANCISCO LOS ANGELES J-1

Canadian Distributors—CANADIAN GENERAL ELECTRIC COMPANY, LIMITED

XCELADUCT

Galvanized Conduit

is

MADE IN CANADA

and sold by

CANADIAN JOBBERS for CANADIAN TRADE

Labelled by Underwriters' Laboratories, Inc.
and the

Orpen Conduit Co., Limited

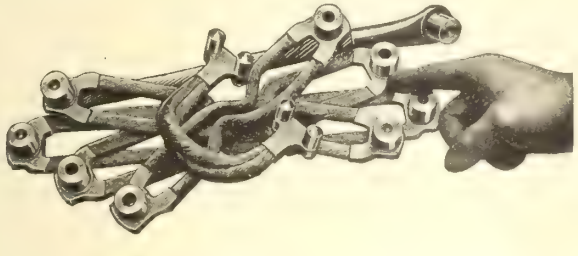
Toronto



Showing "Protected" Rail Bonds being installed by the Union Traction Company of Indiana.

Doing the job right—with "Protected" Rail Bonds and Compressors

Done right—because with "Protected" Rail Bonds the soft copper strands and terminals make fitting easy and permit great compression to assure maximum conductivity.



Done right—because the "Shot-Over" Sleeves permanently protect the strands from the effects of vibration at the point where they emerge from the terminal.

Do it right in the first place—use "Protected" Rail Bonds and Compressors just as they are doing at Anderson, Ind.

Rebonding is expensive.

Electric Service Supplies Co.
Manufacturers
PHILADELPHIA 17th and Cambria Sts. NEW YORK 50 Church St. CHICAGO Monadnock Bldg.

Lyman Tube & Supply Co., Ltd.
Canadian Distributors
MONTREAL Lyman Tube Bldg. WINNIPEG 302 Donalda Block TORONTO 33 Melinda St.

REFLEX Spark Plugs



The REFLEX Line of Spark Plugs is a trade winner. They are made right—stay clean and keep the car on the go. A Gold Bond guarantee against defective material and workmanship is given with each plug.

Every customer satisfied — profits sure—a good line to handle for winning the good-will of motorists and users of engines.

Get the "Reflex" Agency.

Write for full particulars.

Great West Electric Co., Limited
61-63-65 Albert St., Winnipeg, Man.

Stability and Efficiency

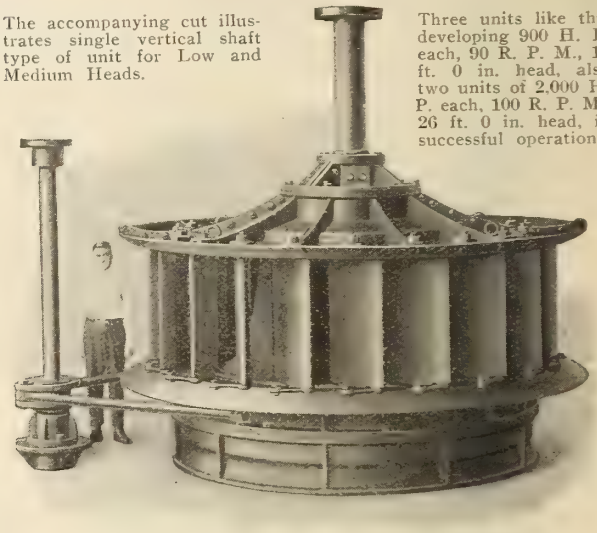
are prime factors in development of Water Power in these days of intense activity.
That's why

SMITH HYDRAULIC TURBINES

are being installed in the "PLANTS THAT COUNT"

The accompanying cut illustrates single vertical shaft type of unit for Low and Medium Heads.

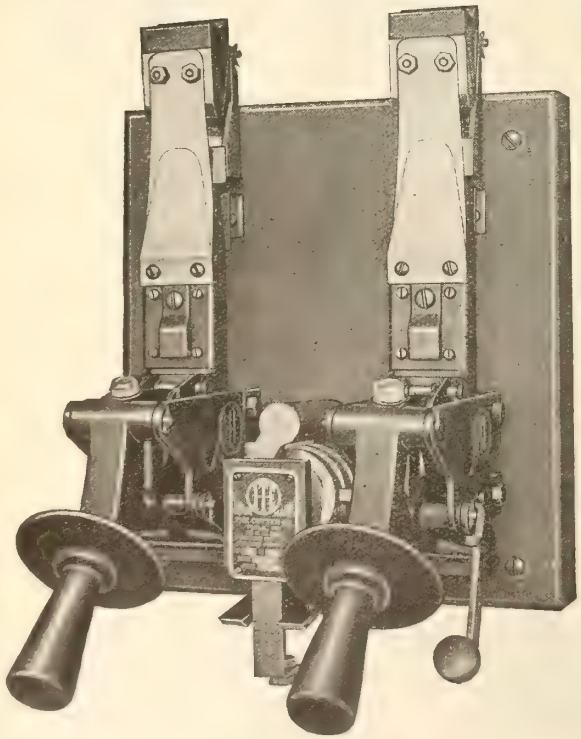
Three units like this developing 900 H. P. each, 90 R. P. M., 15 ft. 0 in. head, also two units of 2,000 H. P. each, 100 R. P. M., 26 ft. 0 in. head, in successful operation.



Write Department "N" for Bulletin of Designs and Useful Data for Hydraulic Development.

S. Morgan Smith Co., York, Pa.
H. B. Van Every, Canadian Representative, 405 Power Bldg., Montreal

I-T-E CIRCUIT BREAKERS



Type W

Rush orders mean unexpected breakdowns unless guarded against. An ounce of CIRCUIT BREAKER PREVENTION will save a ton of trouble.

I-T-E CIRCUIT BREAKERS

pay for themselves frequently before you pay us for them. Prompt deliveries.

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Pittsburgh, Park Building.
Minneapolis, Metropolitan Life Bldg.

ECCLES & SMITH COMPANY
Los Angeles San Francisco Portland, Ore.



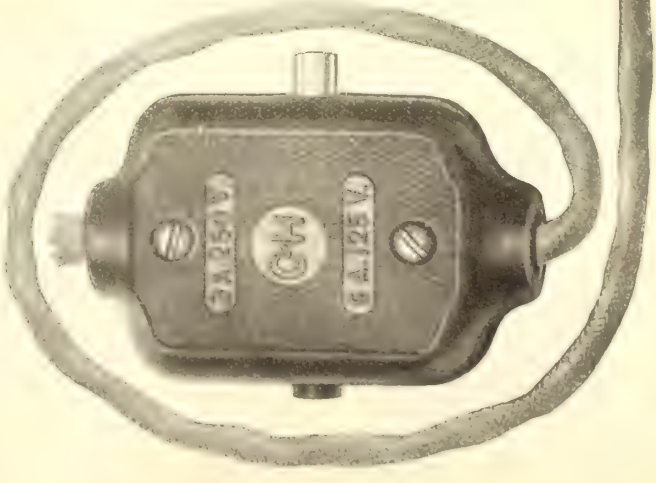
"Put On One Of These Switches Before Delivering My Iron"

"TRYING Mrs. Jones' iron with one of these C-H Switches on, is what induced me to get an electric iron."

'Pulling out the connector plug and seeing the flash at the terminal has always frightened me. And my laundress, now that she has done Mrs. Jones' ironing is strong for electric irons."

The C-H Seventy Fifty SWITCH

removes any last lingering doubt about the use of electrical appliances. It shows when the current is "on" or "off." It makes and breaks the circuit with no display of fireworks. It saves the socket.



The Benjamin Electric Mfg. Co. of Canada, Limited

11-17 Charlotte Street
TORONTO - ONTARIO

Manufacturers of the *Benjamin "92" Two-Way Plug*

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THE "TYPE S" PORTABLE WHEATSTONE BRIDGE



Useful in the Shop and Laboratory for the Measurement of Resistance. Adapted for Fault Locations in Telegraph and Telephone Lines and Cables.

The Type 'S Bridge is a thoroughly practical instrument for shop and field use. Being complete in every detail it is ready at all times for immediate use. It is easily portable, its weight being but 8 pounds. The precision of adjustment of its coils (Rheostat 1/10 per cent., Ratio 1/20 per cent.) insures accurate measurements. The galvanometer, the weakest element of such an instrument, is unusually rugged. It is a separate element and may be removed for examination or repair by taking out two screws. The battery is of the ordinary "flash light" type, and renewals may be procured practically everywhere. The price is $66.25 net, f.o.b. Philadelphia, boxed for shipment.

Bulletin No. 530 describes this instrument.

THE LEEDS & NORTHRUP CO.

Electrical Measuring Instruments

4912 Stenton Ave. **PHILADELPHIA, PA.**



Residence at Oshawa, Ont., a "GALVADUCT" Building.

"GALVADUCT" and LORICATED

"GALVADUCT"

The most perfect interior construction conduit on the market.

Recognized as the standard of high quality.

Always specify Galvaduct or Loricated

"LORICATED"

A high-class interior construction conduit of the enamelled type, proof against acid or other corrosive agents.

If your jobber cannot supply you—write us.

CONDUITS COMPANY

LIMITED

TORONTO



Progress view of Mercury Mills Factory, Hamilton.
A "GALVADUCT" Building.

CANADIAN BEAUTY

CANADIAN BEAUTY ELECTRIC HEATING APPLIANCES

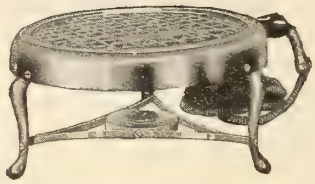
All "Canadian Beauty" Appliances have been approved by the Hydro-Electric Power Commission

Six Summer Specials

that are going to be the big sellers, just as soon as warmer weather sets in. The designs are right—the workmanship and materials are guaranteed—and you can sell them at a handsome profit over cost.



"Canadian Beauty" New Grill



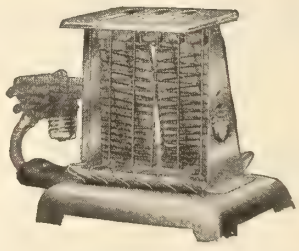
"Canadian Beauty"
8 in. Toaster Stove
Catalogue No. 235. 600 Watts



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Catalogue No. 150. 550 Watts.



"Canadian Beauty" Percolator
Catalogue No. 325. Capacity 6 cups, 450 Watts



"Canadian Beauty"
Upright Toaster
Catalogue No. 200. 450 Watts.



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Order NOW—so we can make prompt shipments.

RENFREW ELECTRIC MFG. CO., LIMITED

RENFREW, CANADA

Onward

MANUFACTURING COMPANY
KITCHENER, ONTARIO



HEAD OFFICE AND FACTORY

EUREKA ELECTRIC VACUUM CLEANER

CHOICE OF PARTICULAR WOMEN EVERYWHERE

BUILT TO LAST A LIFETIME



CLEANS YOUR CARPETS

The GEYSER ELECTRIC WASHING & WRINGING MACHINE

THE WORLD'S MOST EFFICIENT WASHER:
WASHES AND WRINGS AT THE SAME TIME OR INDEPENDENTLY.



WASHES YOUR CLOTHES

Eureka Cleaners and Geyser Washers are Machines of Merit
Ask us for particulars

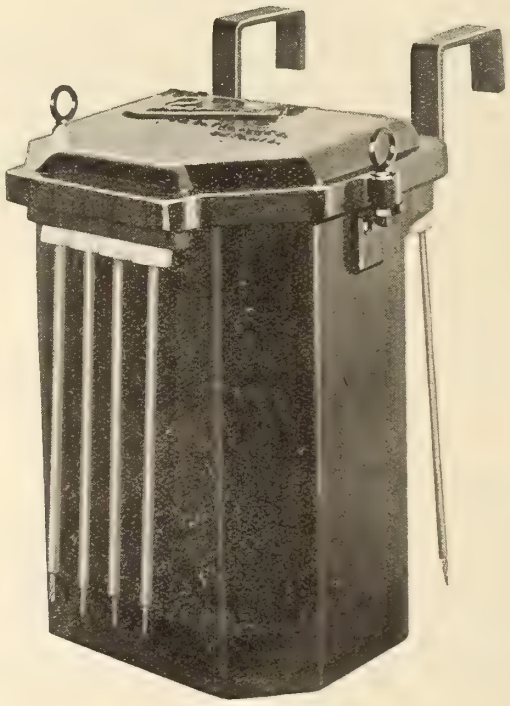
Packard SERVICE TRANSFORMERS

Coils
Impregnated
by
Vacuum Process

Perfect
Insulation

Mica Barriers

Strong
Rugged
Durable



Steel Cases

Light in Weight

Easy to Handle

Will Not Leak

Unsurpassed
Appearance

Operating
Characteristics
The Best

WELDED STEEL CASES

We Build Large Power Transformers
Special Furnace Transformers
Current and Potential Transformers

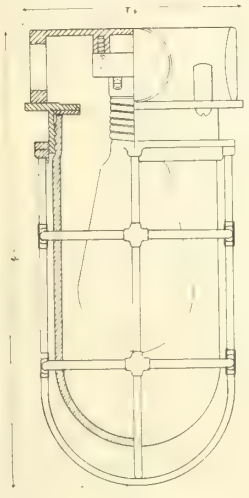
THE PACKARD ELECTRIC CO., Ltd.

ST. CATHARINES, ONT.

Bank of Hamilton Bldg.
Toronto

Donalda Block,
Winnipeg

BULK HEAD FIXTURE



The above cut shows one of the many styles of Marine Fixtures we are prepared to furnish.

STEEL CITY ELECTRIC CO., Pittsburgh, Pa.

APPROVED SERVICE FITTING



Cat. No. FB712

Replaces Types B, BE, F, and FE.

TYPE "FB" ENTRANCE FITTINGS

These fittings have reversible hubs, permitting installation either as type "F" fittings on vertical pipe, or type "B" fittings on horizontal pipe.

The same parts are used for ½ in., ¾ in., and 1 in. fittings, excepting hubs, there being a separate hub for each size. The covers and porcelain are interchangeable from one size fitting to another, giving a very flexible stock arrangement.

Metal parts black japan or galvanized finish. Black japan furnished unless otherwise specified.

KILLARK ELECTRIC CO., St. Louis, Mo

Canadian Sales Agents

HATHEWAY & KNOTT, Inc.

Electrical Merchandise **120 Liberty Street, NEW YORK**

New York Headquarters for the Canadian Electrical Trade

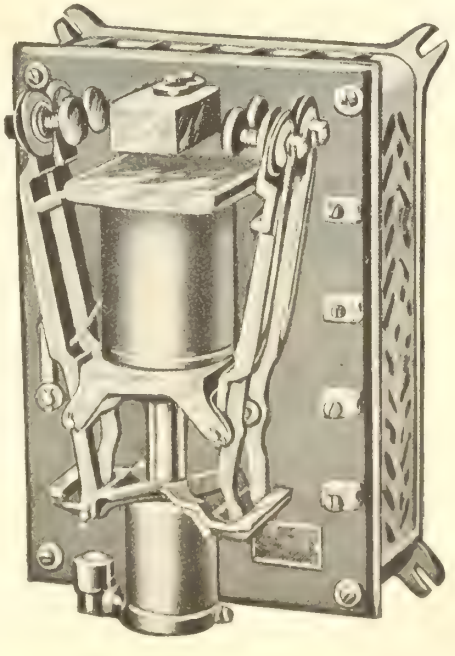
SUNDH SOLENOID MOTOR STARTERS

Compact and reliable starter for Direct Current. No sliding contacts.

The advantages of this type of construction are not only simplicity and easy replacement of wearing parts, but also the elimination of sliding contacts which cause trouble due to arcing and consequent sticking of the moving member.

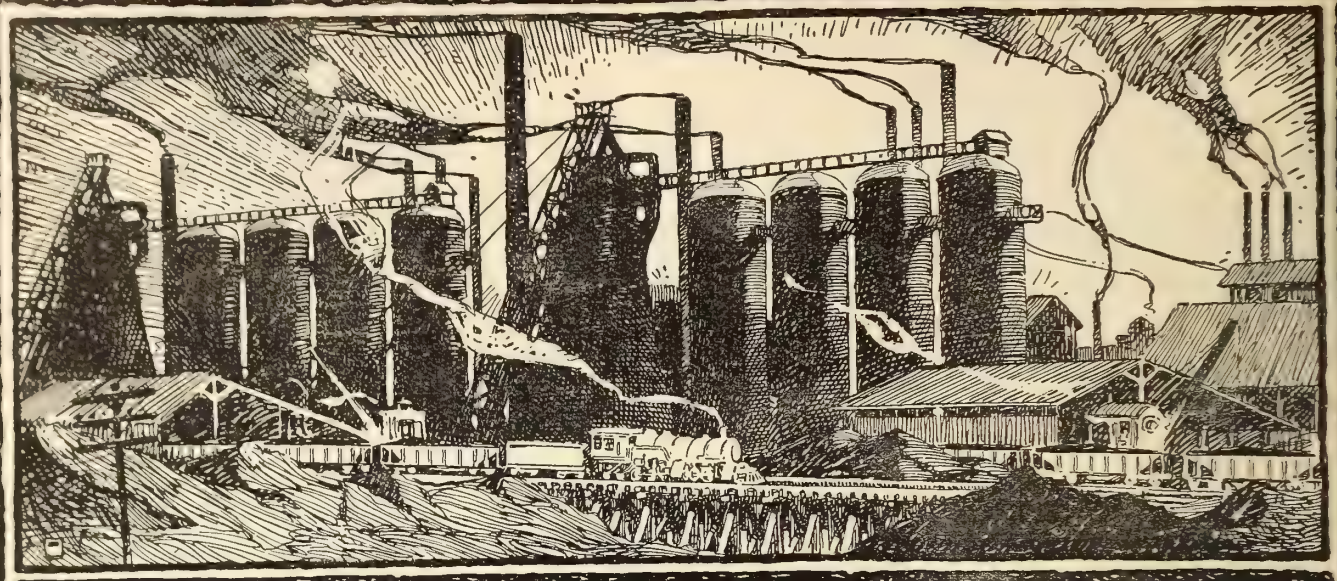
The construction of the Sundh Automatic Starter is compact and simple, consisting of a solenoid, a plunger with retarding dash-pot, and two or more levers hinged to the lower pole-piece of the solenoid.

Send for illustrated Catalogue on Electrical Controlling Devices



The upper ends of the levers carry the contacts. The levers are controlled by their lower ends passing through a frame which is attached to the bottom of the plunger. The contacts are of copper and carbon, and all wearing parts are accessible and easily replaced. For heavy duty the final contact is made by a laminated copper brush. This copper brush, however, does not cut out any resistance, but merely short-circuits the carbon contacts which do cut out the resistance.

Sundh Electric Company — — New York, U.S.A.



LITTLE WORDS WITH BIG MEANING

Quality

According to "Webster," Quality is "an excellence of character; natural superiority."

Service

Webster's definition of "Service" is; "The performance of labor for the benefit of another."

We use these words advisedly—fully understanding their definitions—and realizing the obligation we place upon ourselves by their continued use in connection with our products of Iron and Steel, and our attitude to the people we serve.

THE

STEEL COMPANY

OF

CANADA

LIMITED

MONTREAL HAMILTON

Pig Iron,
Steel & Iron Bars,
Horse Shoes,
Steel and Iron Products.

Steel Billets,
Track Spikes &
Bolts, Forgings, Wire
of every description.

G. M. Gest, Limited

Contracting Conduit Engineers

Head Office
Power Building
Montreal

Vancouver *Winnipeg*

FERRANTI



Pole Type Transformers

Single and Three Phase

HIGH EFFICIENCY— LOW CORE and COPPER LOSSES

Write us for Prices and Delivery before ordering elsewhere.

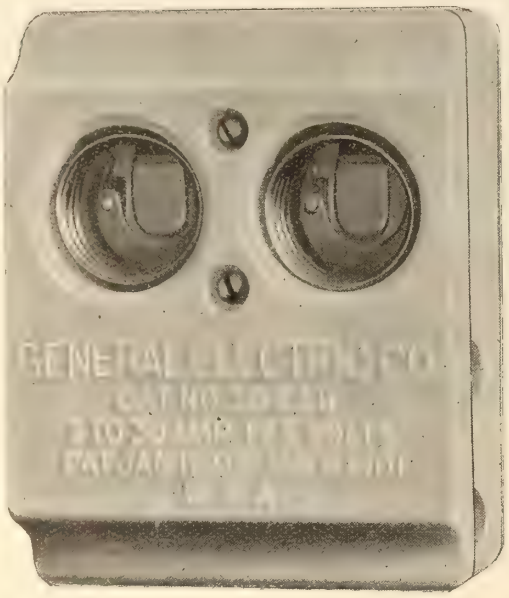
House Service and Power Meters, Ammeters, Voltmeters, Current and Potential Transformers supplied from stock.

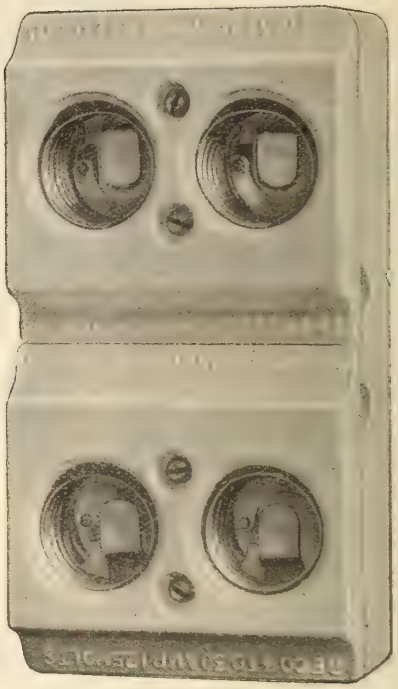
Ferranti Electrical Company of Canada, Limited

90 Sherbourne St. TORONTO | 704 Unity Bldg. MONTREAL | 592 Notre Dame WINNIPEG

FERRANTI FERRANTI FERRANTI

COVERED CUTOUTS





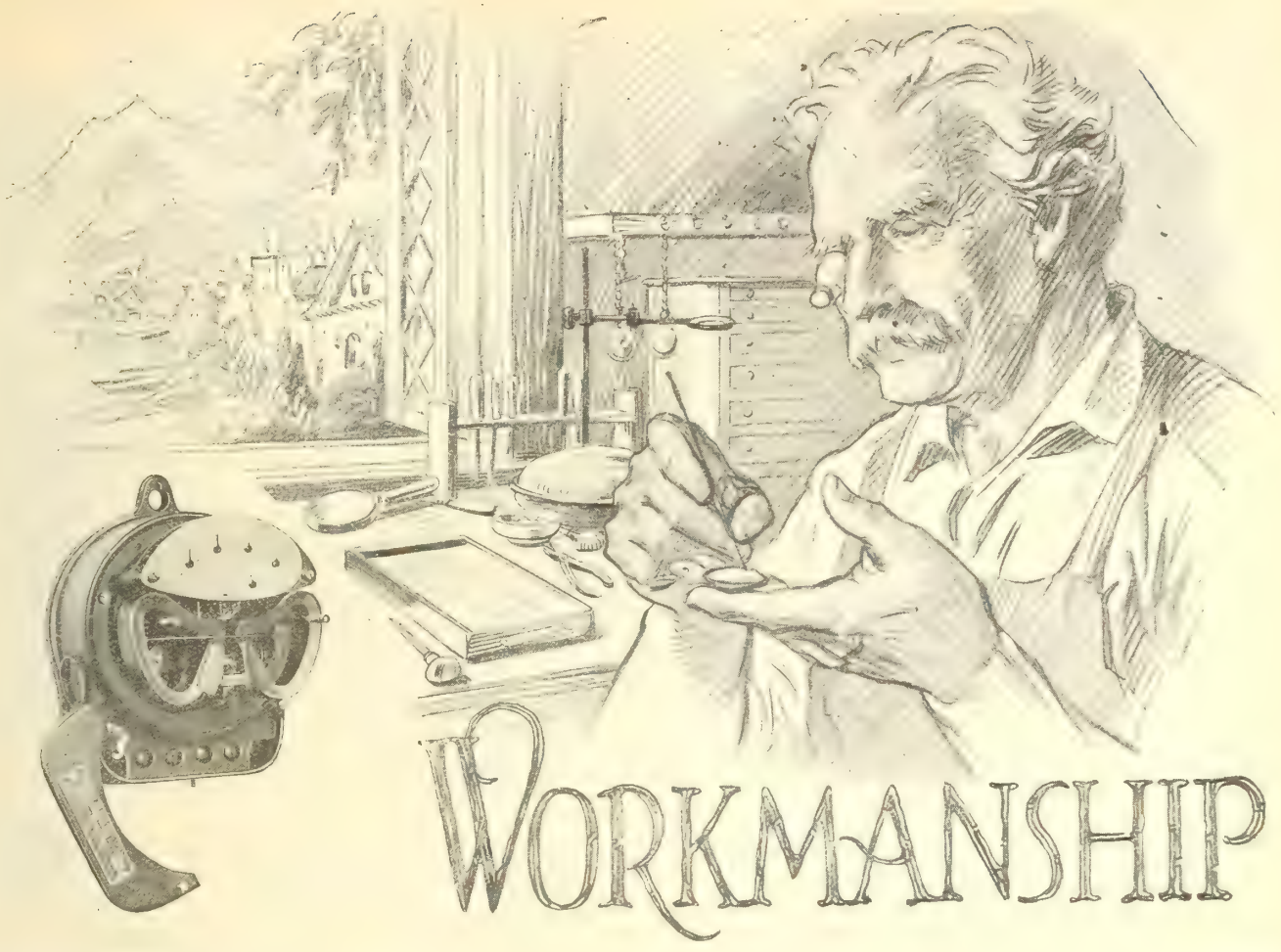
The Use of Covered Cutouts Means No Exposed Contacts

In general use by all leading heating goods manufacturers

And under certain conditions may be used without enclosing in Steel Boxes, for distributing circuits

CANADIAN GENERAL ELECTRIC CO.
LIMITED

Head Office: Toronto. Sales Offices: Montreal, Halifax, Sydney, Ottawa, Cobalt, South Porcupine, London, Winnipeg, Calgary, Edmonton, Nelson and Vancouver.



Type I-14 Watthour Meter

The mere mention of the word "Swiss" in connection with watches recalls something delicate yet durable, accurate though minute. Those world-famed watchmakers have grown up with the trade; they are masters of their art. Each article that leaves their hands for sale, they know not where, is a living replica of their workmanship, is a vibrating proof of their skill.

A meter is in many ways a mechanism as perfect as a Swiss watch. The men who make C-G-E meters also are masters of their craft.

The jewel of the I-14 Meter is selected and minutely scrutinized for bad spots. The little sapphire must be perfect if it is to be used in C-G-E, Meters. In the manufacturing of the pivot bearing, the coils, and the registering apparatus, the same care is exercised. The result is the highly favorable light in which C-G-E Meters are viewed by the discriminating men of the Electrical profession.

CANADIAN GENERAL ELECTRIC CO.

LIMITED

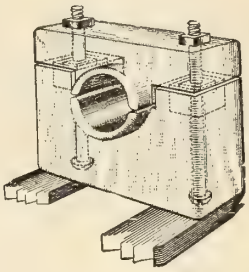
Head Office: Toronto. Sales Offices: Montreal, Halifax, Sydney, Ottawa, Cobalt, South Porcupine, London, Winnipeg, Calgary, Edmonton, Nelson and Vancouver.



"FRANKLIN" Central Station Specialties



Doors for Bus and Switch Compartments
Post Type Insulators
Disconnecting Switches
Bushings



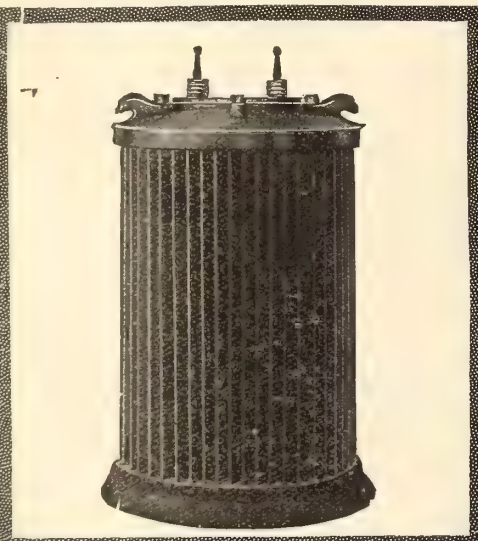
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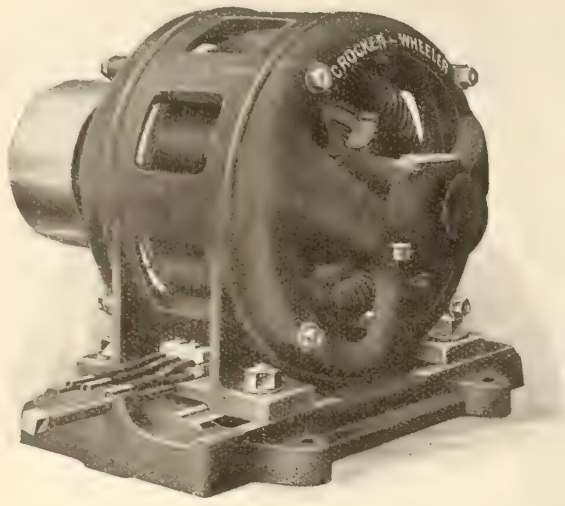
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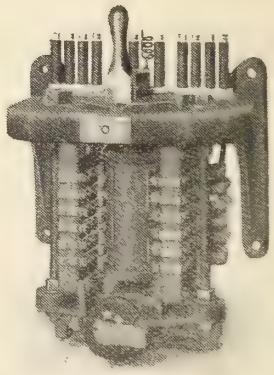
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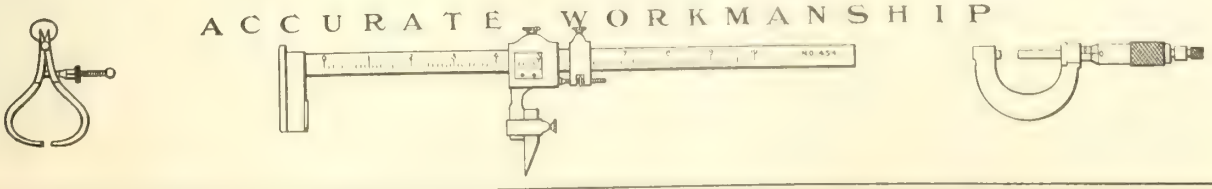
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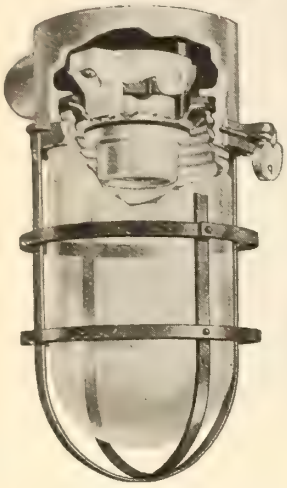
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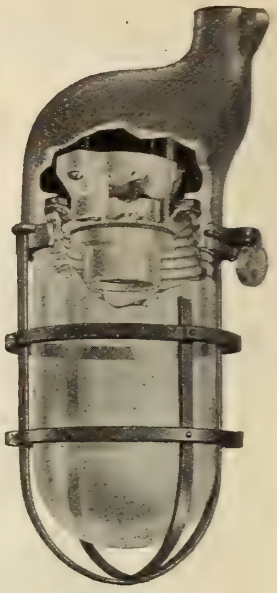
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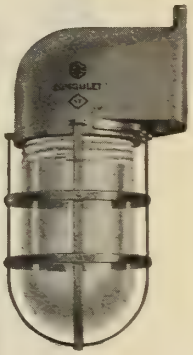
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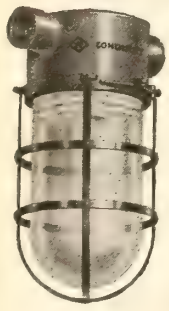
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Generation, Transmission and Application of Electricity

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Power Situation in London Opportunity for Controller Drayton

An acute power situation is foreshadowed in London, Ont., by the announcement of the London Electric Company that they will shut down on April 1. This comes at an unfortunate time, when the Hydro Commission is urging the municipalities to greater economy, and when, therefore, it is a practical impossibility for the London Hydro to take on more customers without causing additional distress to the other Ontario municipalities. It is not to be wondered at that, with the increasing price of everything that contributes to the operation of a steam plant and the difficulty of getting coal at any price, the London Electric has found it impossible to compete with Niagara Falls power. In the present power shortage, however, the shut-down of this plant should be avoided in some way. Doubtless the Dominion power controller will find a ready solution of the difficulty, either by taking over the operation of the plant in the meantime or by instructing the company to continue operations under a guarantee that deficits will be reimbursed. As soon as the summer opens up the Hydro power situation should automatically adjust itself; in that case the London Hydro system could absorb, during four or five months, the entire business that must inevitably fall to them. Dismantling the plant, however, is courting trouble again next winter, and at the moment it looks as if the wisest course would be to continue the steam plant in operation until power shortage on the Hydro lines, winter or summer, is amply provided for.

Canada Leads the World In Fire Loss Per Capita

"Fire Prevention" was the subject of a talk by Chief Tremblay of the Montreal Fire Brigade, at the Montreal Electrical luncheon on February 20. He pointed out that, while practically no progress had been made in preventing fires, the development of electricity had had the effect of reducing fire losses and electrical men had done more in this direction than any others. This was not done with the set purpose of reducing losses, but the progress in their industry had had that result. Many fires were attributed to electrical causes, but whether the allegations were true he was not in a position to say. He declared that many of the fires could be avoided. In Europe, before the war, the loss was 25c per head; in Canada, $3.29; and in the United States, $2.88. Even making allowances for climatic and other conditions, the loss was far too large. Last year the fire loss in Canada was $24,000,000, a very high rate. Insurance companies were partly to blame for this, as they accepted bad risks, secured through agents who did not look beyond securing their commissions. This observation did not apply to all agents, but only to a section of them. Mr. Tremblay advocated the penalizing of insurers where fires were caused by neglecting civic by-laws; he would fine the parties for calling out the brigade, and also prohibit the payment of the insurance money. While we were taking measures to prevent waste no one had given a thought to the waste caused by fires and how to prevent them.

He had commenced a campaign to educate people along the lines of fire prevention, and in the business section of Montreal the results were very satisfactory. This education should be taken up by the federal and provincial governments, municipalities, schools, and factories. It would result in the saving of life and the reduction of premiums. The speaker also advocated the formation of an association in Montreal to take means to prevent fires.

Referring again to the electrical side of the subject, the chief remarked that quite a number of fires were due to electrical causes, and in this connection recalled a recent fire in Montreal in which five lives were lost, due to work being done by a man who had no experience in this line and was told to do the work with old scrap. A considerable amount of work of this kind was done by men who had no practical knowledge, and if this class of work was refused insurance by the companies, the people who were responsible for getting the work done would be compelled to spend money in getting repairs, etc., properly executed. Mr. Tremblay further expressed approval of the act just passed by the Quebec Legislature by which lighting, power and heating systems can be installed only by persons holding licenses.

Mr. W. H. Winter, the chairman, promised the co-operation of members of the luncheon in forming a committee to educate the public on the question of fire prevention.

Half-Cent Rate for Ontario Should Make Electric Cooking Universal

A joint meeting of the Ontario Municipal Electric Association and the Hydro-Electric Radial Association was held in Toronto on February 12. A number of resolutions were carried, including the recommendation that Mr. J. W. Lyon, chairman of the Hydro-Radial Association, be appointed to one of the vacancies in the Senate, so that the interests he represents may be given fair consideration.

Another resolution favored the taking over by the Dominion Government of the Grand Trunk and Grand Trunk Pacific. The C.P.R. was not included. In passing this latter resolution the hydro representatives apparently had in mind the electrification of many of the branches operating in Canada, which, as Sir Adam Beck stated, would remove the neces-

city to embark upon such an extensive scheme of radial lines as had been contemplated.

Sir Adam Beck also took occasion to announce the inauguration of a new domestic rate, designed to encourage cooking and, to some extent, heating. The present scheme calls for the payment of a certain rate, say, 2 cents per kw. h. up to a certain consumption per month, say, 30 kw. h.. and half that rate (in this case 1 cent per kw. h.) for all excess. It is now proposed to make the secondary rate (1 cent in above case) applicable to only an additional consumption of a fixed amount (say, 30 kw. h., as above), and the charge for all in excess (i.e. above 60 kw. h. in the case in question) at half the secondary rate, i.e., at ½ cent per kw. h. It was stated that this rate is already being tried out in Ottawa, and that other municipalities will be allowed to use it as soon as they show sufficient financial strength.

Prison Reform and Capital Punishment

Mr. Robert Bickerdike, president of the National Prison Reform Association, addressed the Montreal electrical luncheon on February 13 on "Prison Reform and Capital Punishment," a subject on which, remarked Mr. Drew, the chairman, in introducing Mr. Bickerdike, members of the electrical luncheon had no inside information. The speaker referred with satisfaction to the progress made by the prison reform movement, particularly in Ontario, where the result had been gratifying. He pointed to the large number of men now at work on the land, practically without restriction, and said that there were probably only 10 per cent. of the total number of prisoners at Guelph who could not be trusted without guards. In the Provinces of Ontario and Quebec a start had also been made in this reform work.

Touching on capital punishment, Mr. Bickerdike outlined many of the well-known arguments in favor of the abolition of hanging. He remarked that in this country we punished for the sake of revenge, which was contrary to the spirit of Christianity. The object of punishment was to reform the prisoners and not to take revenge. He was opposed to capital punishment because it was a relic of barbarism. He stated that he had received letters from the governors of thirteen states in America to the effect that since the abolition of capital punishment crimes had not increased and that in some states it had decreased.

Training Men for Industry

The old methods, such as leading a man to a lathe, giving him some material, and telling him to follow his blue prints, and, if he makes good, patting him on the back, but if he does not make good, firing him, and that of trying to tell a man everything there is to be known about a lathe and material, are now things of the past in the more up-to-date establishments, according to Mr. C. R. Dooley, manager of the education department of the Westinghouse Electric and Manufacturing Company. of Pittsburg, Pa. In Mr. Dooley's talk before the Toronto section of the American Institute of Electrical Engineers on February 15 he outlined the admirable work that is being done by the Westinghouse Electric and Manufacturing Company in East Pittsburg in training the trades apprentices and engineering apprentices in the manufacturing side of electrical engineering. Any educational method should have as its goal leadership, workmanship, and spirit. The speaker claimed that in training men for leadership they could obtain workmanship and spirit as by-products.

In supplying technical assistants to the various executives of the Westinghouse Company, Mr. Dooley found that these executives required their subordinates to have, first, the human characteristics, such as good judgment, initiative, analytical ability, courage, etc., and, as a less important part, technical knowledge of the fundamentals of their profession. The choosing of men was outlined, various methods being employed, among which are Blackburn's phrenology, mechanical tests of Munsterberg, and tests of Warfield Scott of the Northwestern University and Thorndike of Columbia. After the men are selected, the method of training is to place the men in the shops and to carry on their training by presenting to them in a systematic way a series of questions that apply to their daily work. These men can obtain the answers to their questions by asking their foremen, studying the literature of the company, or by any other means they wish. Mr. Dooley emphasized the value of personal discovery, and he said that the best type of teacher was the trained fellow-employee. The situation more or less summed up would be that people are slightly interested in things they are told, but vitally interested in things they take part in.

After the paper a most interesting and heated discussion was entered into, some of those taking part being Professors Baker and Henderson of Queen's University and Professor Price of Toronto University. Those who heard Mr. Dooley will long remember his most excellent presentation of a subject that in the past has been sadly neglected by engineers and employers in general, but one that is coming more and more to be realized as one of the fundamental activities that any live organization should carry on.

March Program Toronto Section A.I.E.E.

Friday, March 1—Engineers' Club, 8 p.m., a paper by Mr. R. P. Jackson, of the research division, Westinghouse Electric and Manufacturing Company, Pittsburg, on the subject. "Commercial and Industrial Research."

Friday, March 8, is the date of the institute meeting at Cleveland, in which the Toronto section is participating as a host. An interesting program of papers relating to underground distribution and the use of electric drive in steel mills has been arranged; also a joint meting with the Association of Iron and Steel Electrical Engineers and an informal dinner.

Friday March 15, Engineers' Club, 8 p.m., Mr. J. J. Frank will come up from the General Electric Company, Pittsfield, Mass., to give a paper on "Recent Developments in Transformer Practice."

More Storage Dams for Quebec

The Quebec Government, in pursuance of its policy of developing the water-powers of the province, has passed several bills authorizing the Quebec Streams Commission to construct further storage dams, this authority, however, being subject to the consent of the Lieutenant-Governor-in-Council. Thus dams may be built on Lake Kenogami, a branch of Lake St. Jean; on the Chicoutimi and Sable Rivers; the St. Anne and Sauvanne Rivers; the Jacques Cartier River, and elsewhere. The expenditure authorized is $4,000,000, but it does not follow that these works will be carried out immediately. The commision has made studies and plans of the possibilities of water storage on numerous rivers. Under another bill power is given to purchase railways, camps, a power plant, shops, machinery, etc., constructed by the St. Maurice Construction Company, in carrying out the contract for the building of La Loutre dam, on the St. Maurice River. The price is not to exceed $500,000. The purchase is subject to the Shawinigan Water and Power Company, Brown Corporation, and Laurentide Company, Ltd., agreeing to reimburse the commission $1,000,000 over the price payable under a previous contract for supplying water by the damming of the St. Maurice. The payment of the $1,000,000 is to be spread over 40 years. The St. Maurice Construction Company also agrees to renounce all claims for extra work incurred in the con-

struction of La Loutre dam, a sum of $298,807 being mentioned particularly in the bill. The amount of $1,500,000 for the La Loutre work, previously authorized, is to be raised to $2,500,000.

The Electric Club of Toronto

The last two February meetings of the Electric Club of Toronto were of unusual interest. On Friday, the 15th, the club was addressed by Col. Gordon Morrison, formerly of the 19th, but latterly in command of the 18th Overseas Battalion in France. Col. Morrison described his experiences from the time he left Toronto until his return on leave, interjecting some fine bits of humor, all going to show that efficient and thorough as the training of our officers may be beforehand, the "Tommy" still has it on him in many points as the firing line is approached.

The guest of the club on the 22nd was Mr. Arthur V. White, consulting engineer to the Commission of Conservation. Mr. White described the negotiations that have taken place from time to time during past years between the United States and Canadian Governments regarding international water-powers, and briefly outlined the treaties and the administrative bodies appointed to adjudicate the matters at issue. In closing, he touched upon the present fuel situation and the possibility of water-power in the form of electricity taking its place. Mr. White's remarks will be reviewed at some length in a later issue.

The speaker for March 1 is Professor G. M. Wrong, of Toronto University, and for March 8, Professor J. C. Fields. The chairman for the month of March is Mr. Frank Kennedy.

Second Acetic Acid Plant for Shawinigan

Announcement has been made by Mr. J. E. Aldred, president of the Shawinigan Water and Power Company, that the company would shortly erect and operate a plant for the manufacture of acetic acid for the United States Government, the whole enterprise to be financed by that government. The plant will be practically a duplicate of the one at present owned and operated by the Shawinigan company through its subsidiary, the Canadian Electro Products Company. The capital expenditure on the Canadian Electro Products plant is given as in the neighborhood of $2,000,000, and the new construction will involve approximately as much. The financial statement of the Shawinigan Water and Power Company, just submitted, shows gross earnings of $2,902,210, an expansion of $576,338, or 25 per cent., while net revenue, after charges and depreciation reserve, amounted to $1,350,864, an increase of $97,128, or slightly less than 8 per cent. The lower ratio of gain in net as compared with gross is explained chiefly in a rise of over $200,000 in expenditure, under the head of "power purchased," and upwards of $150,000 in interest charges. The former increase refers to an increased amount of power taken from Laurentide, a purchase which went to swell gross revenues, and the latter increase is due to enlargement of subsidiary plants the full benefit of which has not been reflected in the company's revenues.

Heat Efficiency of Containing Vessels

Some interesting data on the efficiency of various types of containing vessels when heated over electrical elements is contained in an article by R. G. Kloeffler in a recent issue of the Electrical World. Experiments were made with both open and enclosed units and kettles of both granite and aluminium of various sizes were used. The readings were taken on the amount of heat required to raise the temperature from that of ordinary tap water to 206 degrees F., the consumption being recorded on a standardized watt-hour meter.

The following utensils were used: A small bluish-gray granite kettle, diameter 6 inches; a small aluminium kettle, 6 inches diameter, perfectly flat bottom, called "new" in this article because it had a bright, new surface; a small aluminium kettle, same as above, except that it was discolored and dented on the bottom (called "old"); an aluminium fireless cooker pan, with perfectly flat 8-inch bottom; an agate granite pan and a white granite pan, each 8 inches diameter. All the utensils were fitted with covers.

The efficiency of the equipment is shown in Tables 1, 2,

TABLE I—COMPARISON OF SURFACE UNIT EFFICIENCIES

Type of Unit	6-In. Granite	8-In. Granite Agate	6-In. Aluminum (New)	8-In. Aluminum (New)	Average for Granite	Average for Aluminum	Average for All
Open.....	35.6	42.7	33.3	37.5	39.15	35.4	37.7
Open.....	43.6	52.4	33.3	43.5	48.0	38.4	43.2
Open.....	36.8	46.2	32.2	43.3	41.5	37.5	39.5
Open.....	42.4	47.2	37.2	47.9	44.8	42.55	43.7
Average	39.6	47.1	34.0	43.05	43.35	38.45	40.91
Inclosed...	29.7	43.2	36.6	49.1	36.45	42.85	39.6
Inclosed...	46.4	41.2	53.3	48.7	43.8	51.0	47.4
Inclosed...	29.5	41.5	37.1	54.9	35.5	46.0	40.7
Average	35.2	41.97	42.33	50.9	38.6	46.0	42.3

TABLE II—COMPARISON OF SURFACE UNIT EFFICIENCIES

Type of Unit	6-In. Aluminum (New)	6-In. Aluminum (Old)	8-In. Aluminum (Covered)	8-In. Aluminum (Open)	30-Min. Test (Granite)	60-Min. Test (Average)
Open.....	33.3	28.6	37.5	34.4	58.9	51.5
Open.....	33.3	35.6	43.5	34.2	58.7	51.2
Open.....	32.2	31.4	43.3	31.4	55.0	57.5
Open.....	37.2	32.8	47.9	39.3	55.7	60.8
Average....	34.0	31.55	43.05	34.8	57.07	54.5
Inclosed.....	36.6	22.9	49.1	42.4	60.0	67.5
Inclosed.....	53.3	37.8	48.7	43.75	50.3	64.3
Inclosed.....	37.1	25.2	54.9	51.5	57.5	72.9
Average....	42.3	28.6	50.9	45.9	55.9	68.1
General average			46.97	40.35		

TABLE III—COMPARISON OF SURFACE UNIT EFFICIENCIES

Type of Unit	8-In. Agate Granite (Weight, 0.80 Lb.)	8-In. Blue Granite (Weight, 1.5 Lb.)	8-In. White Granite (Weight, 1.5 Lb.)	8-In. Blue Granite (Weight, 3.00 Lb.)
Open.....	47.2	45.8	44.6	50.7
Open.....	52.4	50.7	50.0	57.2
Inclosed	43.2	40.2	39.1	46.3
Average	47.6	45.6	44.6	51.4

	1100-Watt Unit		1500-Watt Unit	
	Time	Efficiency, per Cent	Time	Efficiency per Cent
	17 min. 20 sec.	52.4	15 min. 50 sec.	47.1
	21 min. 5 sec.	46.2	18 min. 20 sec.	39.4
	21 min. 8 sec.	44.8	16 min. 38 sec.	42.5
Average...	19 min. 51 sec.	48.1	16 min. 40 sec.	43.0

Utensil	New Reflector	Dirty Reflector
	44.7	43.6
6-in. aluminum	36.9	33.3
8-in. aluminum	47.5	43.5
	54.1	52.4
	46.1	43.2
		6.3

and 3. Table 1 gives the figures for open and enclosed units with granite and new aluminium utensils. From the average percentages it may be noted that the open type has approximately 5 per cent. greater efficiency when used with granite than with aluminium. With the enclosed type of heating unit, however, the reverse is the case. The average showing of the new aluminium vessel is 8 per cent. higher in absolute efficiency than the granite. In terms of relative efficiency these figures become 12.7 per cent. and 20.7 per cent. in the two cases. In explanation of these findings the author offers the following:

"The open-type units give up their heat principally by radiation, though some convection and conduction will take place. On the one hand, the granite dishes will readily absorb the radiated heat, while the aluminium, if bright, will have a tendency to reflect the heat downward again. On the other hand, the enclosed unit gives out most of its heat by conduction, with smaller amounts emitted by radiation and convection. Here the granite dish, because the coating of enamel is a poor conductor of heat, does not receive the heat readily, while the aluminium dish, since aluminium is an excellent conductor of heat, acts more efficiently."

Tables 2 and 3 give the results of further tests. These show that the new aluminium utensil is approximately 8 per cent. more efficient than the old one with open units, and about 48 per cent. more efficient with closed units. These tables also give figures using utensils with and without lids. Columns 5 and 6 are computed efficiencies when, after being heated for 30 minutes, the utensils remained on the unit until the boiling of the wated ceased.

The figures in Table 3 indicate that the color of the enamel affects the amount of heat absorbed, though the difference is small. The second section in this table compares the efficiency with the time required for a given rise in temperature, using two different heating units of 1,100 and 1,500 watts respectively. The results show that the extra time is gained at an increase in total cost. The last section of Table 3 indicates that the units show a decrease in efficiency after being in service for a time.

Electrical Hazards in Bathrooms

Editor Electrical News:

I have read with much interest your timely article on the above, and agree with you that accidents such as the one alluded to should not be lightly passed over.

In our practice in Winnipeg we have largely prevented the use of portable devices in bathrooms by insisting for some years upon lamp sockets or receptacles being placed out of reach; but, where radiators are required, we either see that the receptacle is placed well away from the plumbing fixtures or call for the grounding of the radiator frame.

A close study of this problem will, I think, lead to the conclusion that ultimately we may find it advisable to follow the British practice and call for the grounding of the frames of portable devices. Such a rule has applied for work coming within the scope of the British Factory and Workshops Acts since 1908. This protection is also recommended by the United States Bureau of Standards in their "National Safety Code," November, 1916, in which it is stated that "the permanent grounding of frames of portable devices, etc., when the devices are used within eight feet of the floor in locations such as bathrooms, laundries, etc., where persons may easily touch grounded surfaces at the same time as the device, is recommended as a safety measure. Such grounding may be obtained by the use of a three-wire portable cord with the portable device, one wire being used for the ground conductor and the connections being properly designed so that wrong connections cannot be made by the user."

It might be profitable to have a discussion of these problems and any safeguards proposed, and I would be delighted if some of your readers would let us have their views, especially as to whether the new rule of the National Code (1918 edition) calling for the continuous identification of the neutral wire would afford a solution of the difficulty by using the same as a "ground." Of course, certain obvious fundamentals would be necessary in such a case—for instance, no grounding of secondaries by means of driven rods would, I venture to say, be considered an adequate form of grounding in such a case.

Yours truly,

(Signed) F. A. Cambridge,
City Electrician,

Winnipeg, Man.

A Travelling Anti-Waste Exhibit

In a large manufacturing plant where thousands are employed it is surprising to learn of the food products and manufacturing material wasted each day. To give the employees of the Westinghouse Electric and Manufacturing Company some idea of the waste the management devised the novel scheme of fitting up a storage battery truck as a travelling exhibit, upon it a collection of foods wasted, including bread, butter, meat, cakes, crackers, pickles, cheese, fruits, etc., as well as a quantity of manufacturing materials, such as copper, zinc, lead, mica, rubber, felt, gum, and similar materials, much of which could be used to advantage. It is estimated that the foodstuffs wasted per day amounts to between $35 and $50, the cost of which, of course, comes out of the employees' pockets, the waste of material amounting to hundreds of dollars per day, which would be a loss to the company if it were not that a force of men are continually assorting the seemingly scrap material and turning it back for use or so that the highest price may be obtained for scrap produce, all due largely to the thoughtlessness and carelessness of the employees. Above the material was constructed a sign reading, in large letters, "Wasted," and underneath the words, "Food brought from your homes," and on the other side, "Materials belonging to the company." This truck was driven up and down the shop aisles so that the employees could look upon it and form in their minds some idea of the waste. Such an object lesson is valuable at this time, when everyone should take all precautions necessary to effect as little waste as possible.



Striking exhibits of waste products.

Transmission Line Practice—Poles and Towers—Article III.

By Lieut. E. T. Driver and E. V. Pannell

The properties of conductors have occupied the first two articles in this series; it is next necessary to consider the line supports. First and foremost among these is the wood pole. It has been pointed out by Mr. R. D. Coombs* that the wood pole is very nearly ideal as a line support because the stresses it has to carry are almost identical with those which Nature designed the tree to withstand. The difference is, however, that the tree is permeated with living sap, whereas the pole is not, hence the elasticity of the latter will probably be lower and unless its cells are impregnated it will be subject to decay. Since the primitive days of power transmission, when poles were felled and trimmed right along the site of the line, the selection of poles has been more carefully studied, with the result that certain materials, e.g., white cedar, red cedar, and chestnut, have been found, from their natural impregnation, to be most resistant to decay, and have practically become standardized wherever they are readily obtainable. In view of the extended use of wood poles in Europe for telegraph and power lines, the practice of impregnating the whole pole as followed in the old world is of interest. The specification of the British Board of Trade states: "Poles shall be sound winter-felled red fir, free from long knots or other defects, and with the natural butt, and shall be well injected with creosote." The standard quality of creosote or wood tar injected amounts to 10 lbs. per cubic foot of pole. In addition, the butt and gains are frequently painted with a coating of hot Stockholm tar. Poles treated in this manner have been found to yield a life of thirty years or more.

In America it is now universal practice to treat the butts and crossarm gains with carbolineum, and in view of the increased demand for reliability and the growing cost of renewals, it is probable that all poles will sooner or later be completely impregnated in a tank, as is done in England. Not the least advantage of a thorough treating process is that it places a cheap pole lumber, such as pine or Douglas fir, almost on a par with cedar, in respect of durability.

Wood poles offer much less diversity than specially designed steel transmission structures, as they are purchased in a limited number of stock sizes, against specifications covering size, straightness and general freedom from defects. Most of the cedar poles in use for modern transmission lines fall within the Classification A of the National Electric Light Association, (see Fig. 8). Such poles as are covered by this specification will readily sustain the stresses arising from a three-phase circuit of No. 4/0 copper on spans of 200 feet. Heavier conductors will be taken care of by the use of the same pole on a shorter span length. With the high transmission pressures now in use a double circuit cannot be satisfactorily mounted on a single pole; even with a single circuit the limit of a pole is reached at around 50,000 volts, beyond which the crossarms become too long. This problem is met by bracing two poles together in the form of an H with one horizontal crossarm across the top. This type of construction is being used by the Appalachian Power Company (80,000 volts), Central Colorado Power Company (100,000 volts), and the Montana Power Company (100,000 volts). This construction provides a reserve of stability so that the span length can be reasonably increased. For corner and dead end stresses the construction is still further modified by the use of a four-pole structure mounted on a square base and guyed.

*("Pole and Tower Lines," McGraw, New York).

However, notwithstanding the simplicity and economy of wood pole lines, steel towers are now standard practice for modern high tension lines. A span of eight hundred feet can easily be handled by one steel tower carrying two circuits, whereas H poles mounted every two hundred feet would be necessary to carry one of these circuits only. The total number of poles replaced by one tower would, therefore, be sixteen. Further, the tower line would require six insulators per eight hundred feet, whilst the pole line would necessitate twenty-four. The difficulty of obtaining reasonably good deliveries on steel shapes has recently been the reason for the installation of several important transmission lines with wood poles, but this condition is only a temporary one.

The first steel tower line to be erected for power transmission was that of the Guanajuato Power Company, in Mexico, in 1903, and the number of towers erected in the succeeding fifteen years is estimated at half a million. During this period the design of the transmission structure has

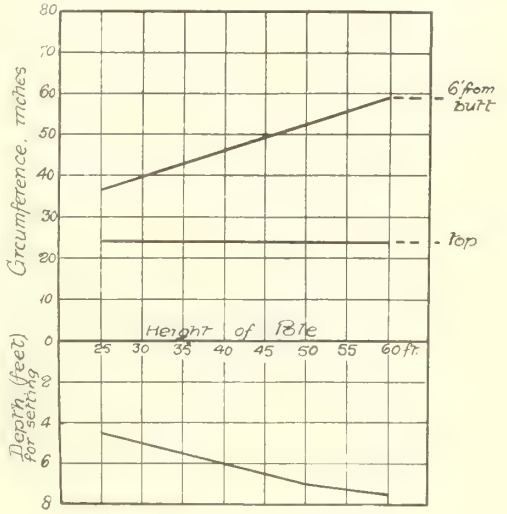
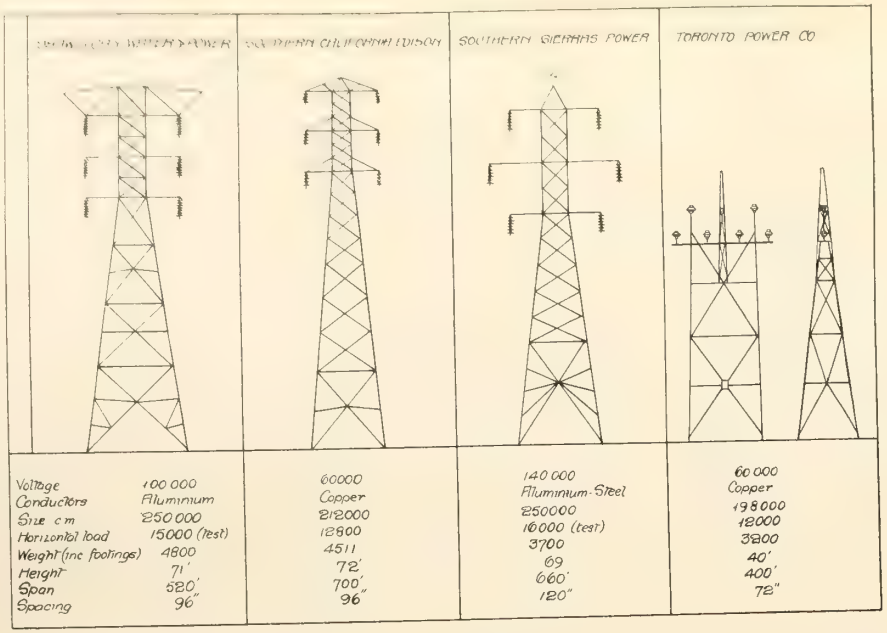
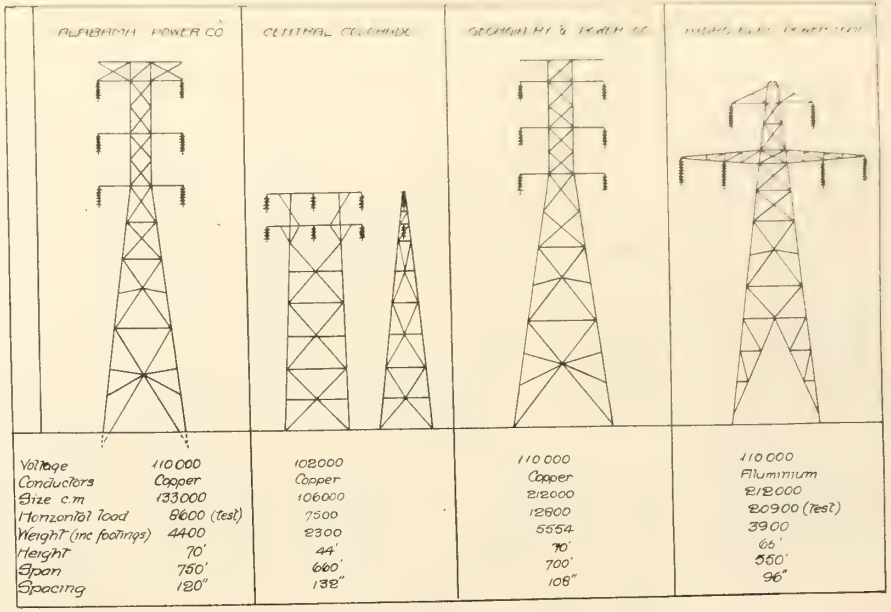
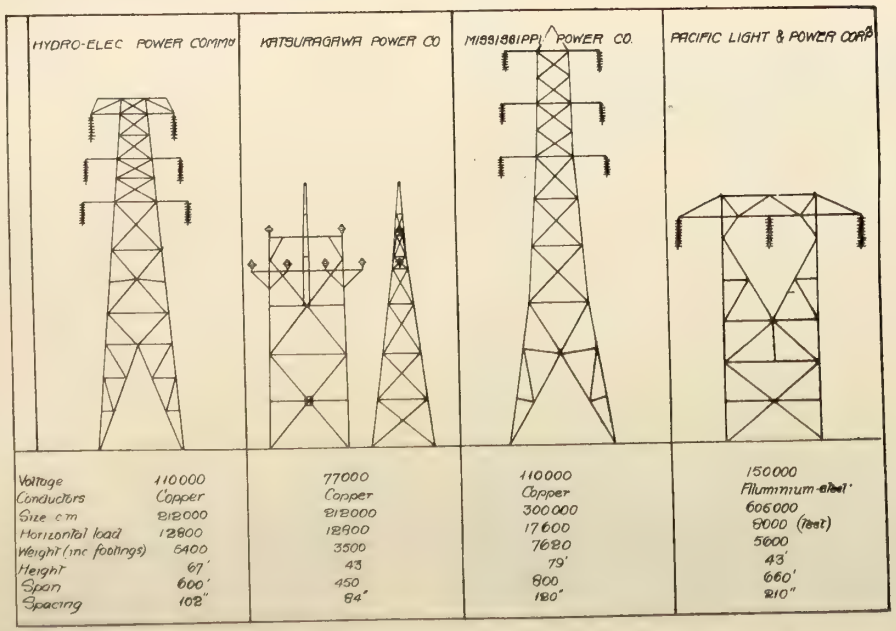


Fig. 8—Proportions of Cedar Poles (Class A, N.E.L.A. Specification)

been carefully studied, until its stresses and their distribution are fairly well understood. The principal loads sustained by any transmission line support are of two kilns, (a) transverse, and (b) longitudinal. The first is the total horizontal load due to the summated wind pressure on all the ice-covered wires of a span plus the wind pressure on the structure itself. As already shown, the wind load on the wires is commonly accepted at eight pounds per square foot of the projected area; this including a correction factor for cylindrical surfaces of sixty per cent. On the tower members themselves the surface being flat the wind pressure will be $8/.6 = 13$ lbs. per square foot, and will be figured upon twice the area of one side. Except in the case of a dead end or corner tower the longitudinal load (b) is very small, with a well constructed line, but it is necessary to allow for abnormal conditions. Along the line normally the pull on the tower from one side is exactly balanced by an identical pull on the other side. Should two cables swing together and burn off there will be an unbalanced pull on the tower crossarm amounting to the tension in these two conductors just before parting. However, several features come in to reduce this unbalanced pull, and it will be found that it







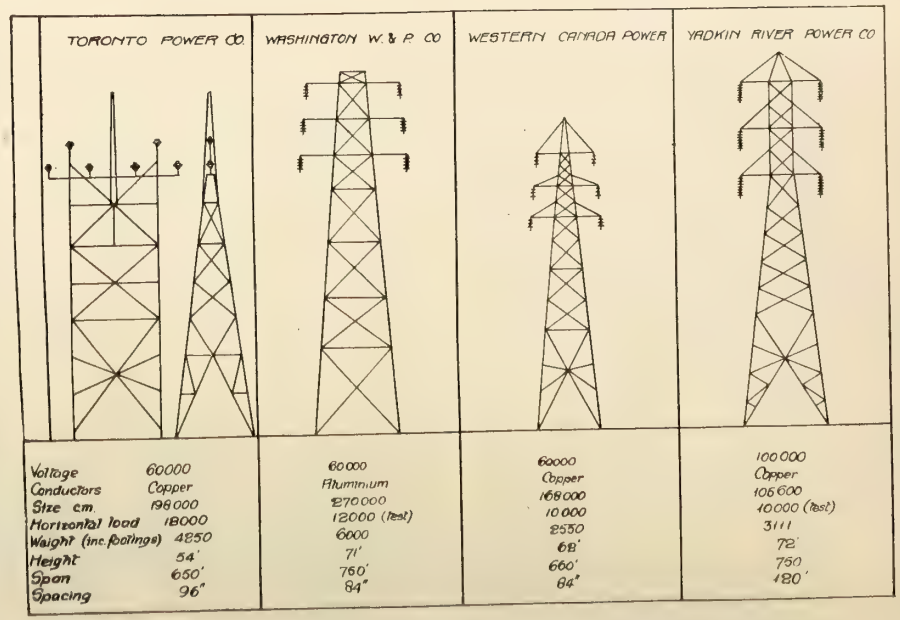


Fig. 9—Some idea of the diversity of tower designs may be obtained from these diagrams and the descriptive information accompanying each.

can never be quite as great as calculated on the above basis, and in most instances is probably very much less. As each wire breaks the suspension insulator swings up into line with the next span. This very short additional length considerably relieves the stress. Even in the case of pin type insulators where there is no such flexible element, it will be found that the cable slips through the tie wire before the tower can yield. Furthermore, from the properties of a suspended wire it is obvious that every fraction of an inch

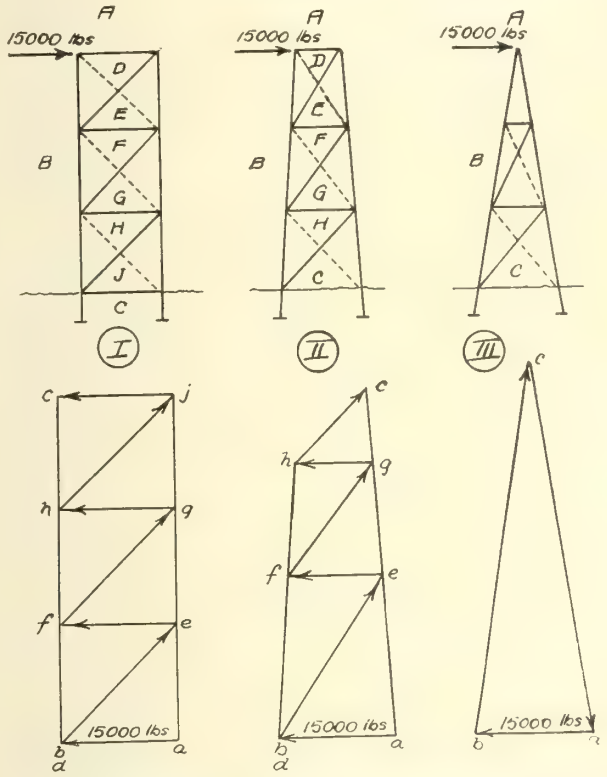


Fig. 10—Structure and stress diagrams for three elementary types of transmission line towers under concentrated test load of 15,000 pounds horizontal. The dotted ties carry no stress with the load on the side as shown. No allowance for weight.

which is added to the length of the catenary will cause a considerable reduction in the tension. Now every transmission tower will yield a few inches without failing, and so automatically relieve the horizontal load.

However, it is considered good practice to assume working conditions a little more severe than they actually are, and the average test requires of a suspension tower that it shall not fail until a pull amounting to the tension in half of the conductors on one side is applied. Except in the case of very small conductors, this stress is considerably greater than the transverse wind load, and forms the basis of the design for the towers. It is obviously unsatisfactory to design a tower with light bracing in one direction and heavier members on the other sides, just because one set of loads is less than the other; the whole structure is figured on the basis of the greater load. Consider a double circuit line of No. 4/0 copper with two 3/8 in. ground wires of galvanized steel strung upon a span of 600 feet. The lateral wind pressure per foot on this size of wire with ½ inch ice will be 1.01 lbs. and the total span will amount to:

$$6 \times 1.01 \times 600 = 3640 \text{ lbs.}$$

The load per foot on the 3/8 in. ground wire is .91 lbs. and the total

$$2 \times .91 \times 600 = 1090 \text{ lbs.}$$

$$\text{Total Load (a)} = 4730 \text{ lbs.}$$

Now consider the pull generated by the failure of three cables at the maximum stress. This stress amounts to 30,000 lbs. per square inch with copper and as a No. 4/0 cable has an area of .166 square inches the tension amounts to 5,000 lbs. per cable. When three cables fail the total load is

$$\text{(b)} = 15{,}000 \text{ lbs.}$$

or three times the maximum transverse load.

It is common practice to specify a test load applied diagonally being the resultant of loads (a) and (b). However, load (b) if figured upon three conductors failing would seem to provide ample margin of safety.

These foregoing observations apply to suspension towers. Where a corner has to be turned in the line or the cables have to be dead-ended, the structure must have considerably more stability, and it is usual to test such a tower with a horizontal load equal to the failure of all the cables on one side, or, in other words, with double the load of a standard structure. Such towers will be spaced from one every tenth to every sixth span, and still more frequently in uncertain ground, or where the alignment changes. From 70 to 90 per cent. of the line towers will, however, be of the standard type. The function of the tower is to transmit the horizontal load (which usually is assumed to centre on the middle crossarm) down to the footings. Fig. 10 shows diagrammatically how a single concentrated load (such as a test loading) is distributed in the fundamental types of tower. The designs have been simplified as far as possible in order that the principles may be made plain. Most actual towers are a combination of two of these types, being generally similar to I. or II. across the line and to II. or III. in the line direction. Since as already seen the stresses in

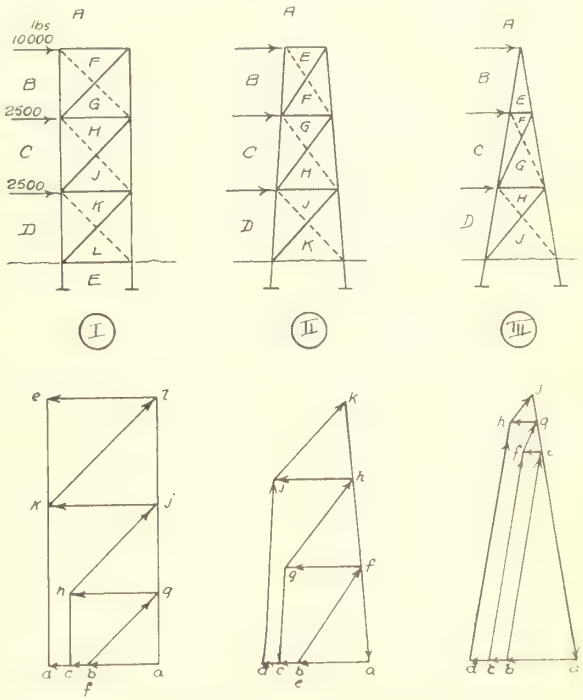


Fig. 11—Structure and stress diagrams for three elementary types of transmission line tower under a distributed (wind) and concentrated (cable) load. Type I requires the strut LE to carry the horizontal load, but this member becomes less necessary and is seldom used with sloping legs. The tension members, shown dotted, of course come into action when the load is on the other side.

this latter direction form the basis of the design, types II. and III. will naturally be of the most interest; however, the main point to observe in reference to Fig. 10 is the manner in which the stresses are accumulated upon the lower section of the tower legs. Fig. 11 brings the matter a stage nearer to actual operating conditions, as, instead of one horizontal test load near the apex of the tower, a slightly smaller load is applied at the same place, together with a dis-

unlimited load due to wind on the structure. This leads to a different distribution of stresses in the bracing, but the main compression load is carried by the lower part of the corner members as before. The bottom horizontal member KL in type I. is dispensed with as being less necessary in the other designs where the sides are battered. However, the lowest diagonal has to carry the same horizontal stress in any case and a danger exists of making the bottom panel between ground and the lowest strut too long for safety. Ten miles of an important transmission line was wrecked in one night owing to too long an unsupported panel causing the tower legs to shut up like a pair of scissors. It is best for the joint between the bottom diagonal and the tower leg to be made about a foot below the ground surface. This enables the horizontal component of the load to be transmitted to the tower leg without any appreciable shear and the practice has been adopted by the Alabama Power Company on their recently erected lines.

Apart from this somewhat troublesome horizontal load, the principal stress in the structure is the compression in the legs, and where other things are equal and the footings are good, the tower will not fail until the main compression angle buckles. To ensure the maximum strength against buckling the legs are frequently cross braced to reduce to a minimum the unsupported length and the ratio of this length to the minimum radius of gyration of the section is kept at the lowest practicable proportion. A ratio of 100 represents good design, and 120 is the maximum desirable. Since r for an equal sided angle is approximately b/5 (where b is the breadth of the angle) then to secure a maximum l/r ratio of 100 the unsupported length must not exceed twenty times the width of the angle. A common size of corner angle for a heavy tower is 4 in. x 4 in. x ¼ in., in which case it will be seen that the maximum length between cross struts should not exceed 80 ins.

Several formulas exist for calculating the buckling stress on a strut and four of those in use for tower work are given below. These are supposed to give the safe load based on a safety factor between two and three:

National Elec. Light Assn. $p = 24000 - 60 \times l/r = 18{,}000$ lb.
Rankine $p = 21500/(1 + l^2/36000r^2) = 16{,}800$ lb.
Alabama Power Co. $p = 25000/(1 + l^2/18000r^2) = 16{,}100$ lb.
European (Tetmajer) Formula $p = 22000 - 81\ l/r = 15{,}900$ lb.

The last column gives the actual stresses obtained by using the formula for a ratio l/r of 100 and it will be seen that there is quite a disparity, which is a good reason for adopting a liberal factor of safety in figuring this stress.

Some idea of the diversity of tower designs is afforded by Fig. 9; however, it will be found on analysis that their design is in every case based upon the principles outlined above. The figure for horizontal load given in this diagram refers to the tension in three conductors for a double circuit tower, and in two conductors for a one circuit structure, except where it is defined as the actual test load.

Flexible towers or A frames, have not been treated in this article; their design is based on the distribution of transverse loads only except for the anchor towers, which are figured like any other four-leg structure. The A frame is based upon the presumptions already mentioned, that in the case of two or more cables failing the load on the support is less than that calculated, because (a) the insulators and tie wires will yield, and (b) the tower will yield sufficiently to equalize the stress, and (c) the remaining conductors and the ground wires will afford stability.

The fourth article in this series will appear in the April 1 issue, and will be entitled "High Voltage Considerations."

What Does Electric Illumination Cost?

Fuel Saving by Curtailment of Light is Very Little in Comparison with the Possible Economies in Other Directions

By Preston S. Millar*

The cost of artificial illumination of all kinds is one-half to two per cent. of the total expenditure of the people. It compares with certain other expenditures as follows:

Illumination	$500,000,000
Liquors	665,000,000
Tobacco	490,000,000

Coal Consumed in Electric Lighting

The significant figures to have in mind when discussing this subject are as follows, all being rough approximations:

Approximate Coal Consumption for 1917

	Tons
Total coal output of the country (United States).	640,000,000
Total employed in production of electric light and power (traction excluded).	36,000,000
Total employed for production of light by electricity	12,000,000

According to these estimates, about 2 per cent. of the coal consumption of the country goes into electric light. Some comparisons may assist to provide a proper perspective for the consideration of these data.

	Tons
Coal shortage the equivalent of which must be saved	50,000,000
Estimated saving in coal during 1914 if all private plant power could have been replaced by central station power	13,000,000
Estimated saving in coal by maintaining temperature of building interiors at 67 degs. F. instead of 70 degs. F.	10,000,000

It is evident, therefore, that the total consumption of coal in the production of all electric light is relatively not a very large item in the coal consumption of the country. If the entire electric lighting of the country were cut off the saving in coal would be only twenty-four per cent. of the required saving, and no more than would be accomplished by a reduction of readily practicable extent in the heating of buildings. In considering lighting curtailment, therefore, it is important to bear in mind that even if every candlepower of electric lighting were wasted the loss of coal involved would not be the great outstanding coal waste of which this country is guilty. As relatively little light is wasted, it is evident that the amount of coal which can be saved by curtailment of electric lighting is small. Our discussion has to do with the saving which it may be possible to effect in the 2 per cent. of the country's coal which is consumed in electric lighting.

Present Status of Artificial Lighting

Before the present period of fuel stringency, the employment of artificial light had increased rapidly. In some classes of service it had attained a stage which in the present state of the art was considered by experts to be reasonably satis-

* Before Illuminating Engineering Society.

factory with respect to intensity, though not so in respect to the manner in which the light was used. Such a condition, however, was exceptional. Upon the whole artificial lighting has been inadequate, considering the best advantages to the public. Safety, conservation of vision, economy in production, commercial success, and aesthetics, singly and in various combinations, require improved utilization of artificial light which in many, if not in most cases, involves the production of more light.

Within the past two weeks the author has requested a number of members of the Society to express their views as to the adequacy of standard lighting practice. The concensus of the opinions secured is presented in the following table:

Classes of Lighting Service	Present Day Ideas of Desirable Practice as Compared with Practice Just Before the War
Street (civic, not white way)	+ 70%
Public Buildings (schools, colleges, institutions, etc.)	+100
Industrial	+175
Protective (outside and inside)	+400
Commercial (offices, stores, etc.)	+ 40
Residence (including hotels, clubs, etc.)	+ 30
Recreational (churches, theatres, saloons, etc.)	0
Advertising (signs, white way, show windows, etc.)	0
Miscellaneous	+100

Assuming a distribution of illumination among the several classes of lighting service named it develops that according to the consensus of opinion of these 10 men, electric lighting as a whole ought to be increase by about 73 per cent. in order to conform to the concensus of their opinions as to desirable intensities.

In relatively few instances has more artificial light been employed than the circumstances warrant. There is occasionally encountered a popular opinion that artificial light is used more largely than is necessary. The phrase "over illumination" appears to have found some place in popular parlance. The origin of this impression is to be found not in the use of too much artificial light, but rather in the glare of exposed light sources which are excessively bright and which create the impression of high illumination. Good illumination involves correct practice in respect to intensity, diffusion and color of light. When the artificial illumination is correctly designed as to diffusion and direction, there is no suggestion of over illumination. To talk of over illumination by artificial light is unreasonable, in view of the fact that intensities range from, say, a minimum of 0.01 foot-candle outdoors to a maximum of 5 foot-candles indoors, while sunlight as we employ it ranges from, say, 10 foot-candles indoors to a number of thousands of foot-candles outdoors. How then is it possible to speak of over illumination by artificial light, when the brightest artificial illumination is only, say, one-quarter of the least bright sunlight which is used for the same purpose within buildings?

Let us base our consideration firmly upon the fact that indiscriminate curtailment would involve reduction from lighting standards which are less than adequate.

Estimate of Practicable Curtailment

The author has prepared the following rough estimates of the manner in which artificial light is distributed among the several classes of service adopted as a classification for this purpose. There are no general statistics on this subject. Some fragmentary data and the opinions of several men engaged in the lighting business have been obtained. It is to be emphasized, however, that these figures should not be accepted as anything more than very roughly approximate.

Beside these figures showing approximate distribution of lighting among several classes of service are figures representing the concensus of opinion of ten qualified observers as to the extent to which lighting in each class of service ought to be curtailed or increased in the present emergency. The values are probably reasonably indicative of expert opinion on this subject at the present time.

Adjustment of Illumination Intensities which According to Expert Opinion Ought to be Made from Standards Existing Before the War in View of the War and the Fuel Shortage

Class of Lighting Service	Per Cent. Distribution	Desirable Adjustments in Intensity
Street	15	— 50
Public Building	3	— 10
Industrial	18	+ 50
Protective	1	+200
Commercial	20	— 20
Residence	26	— 20
Recreational	7	— 40
Advertising	5	— 80
Miscellaneous	5	— 10
	100%	Net — 7%

The final adjustment of artificial light which ought to be made at the present time depends on the one hand upon the need for obviating extravagant lighting and eliminating waste, and on the other hand upon the importance of promoting industry and safeguarding lives and property. The net adjustment based upon the estimates and opinions summarized in this table, appears at the foot of the table and is of the order of —7 per cent. Adjustments in particular classes of service range from a maximum curtailment of —80 per cent. in advertising lighting to a maximum increase of + 200 per cent. in protective lighting.

One may ask why this net saving should be adopted as the conclusion from this survey instead of 17½ per cent., which is the gross saving from which no deduction is made to cover the desirable increases. The author would consider himself unworthy to discuss this important subject before the Illuminating Engineering Society, if he failed to insist that except in the presence of an actual coal shortage which could not be compensated by saving elsewhere, the increases in intensities which are recommended for certain classes of service are more important to the public welfare than is the coal saving which it is desirable to effect in other classes of lighting service. The net saving, therefore, is the value which should enter into our calculations.

It will be recognized that both the extent of lighting and the level of illumination intensity in each class of lighting are involved in this survey. In protective lighting, for example, it is a more extensive application rather than higher intensity which is required. In industrial lighting, on the other hand, higher intensities are deemed advisable.

Desirable readjustment of artificial lighting to meet war conditions and to assist in meeting the coal shortage, consists, therefore, in eliminating extravagant and unnecessary light, in reducing the intensity in a few places, in increasing the intensity in a few classes of lighting and in extending lighting in other classes of service.

Methods of Lighting Curtailment

Various methods of reducing artificial lighting as a war measure have been proposed as follows:

1. Remove unnecessary lamps.
2. Extinguish all lamps when they are not needed.
3. Extinguish some of the lamps when possible.

(1) Substitute smaller sizes of lamps.

(2) Replace inefficient by efficient lamps.

Other Means of Saving Fuel

To arrive at suggestions for saving fuel used for lighting purposes without deleterious effect, one should consider the elements of inefficiency in lighting, and the possibility of eliminating them. Such a line of consideration brings the following to the fore.

Good Utilization of Light.—Selection of suitable reflectors or other lighting accessories may in some cases make it possible to provide equally good illumination while using smaller or fewer lamps.

Good Maintenance.—Dirt cuts down lighting efficiency markedly. Statistics are available to show that cleaning of lamps and lighting accessories has increased the useful illumination by as much as one-third. It is reasonable to state that the difference between good and poor maintenance of a lighting system will account for 20 per cent. of the total light.

Use of Good Reflecting Surfaces.—Good white paint or other good light reflecting surfaces conserve light materially. Sometimes a wall or side of a building may be whitewashed with the result that more daylight is reflected into an interior, thus reducing the use of artificial light.

Other measures which are attracting favorable consideration but which are not within the scope of illuminating engineering, include the following:

Daylight Saving.—The adoption of summer daylight saving as now proposed is estimated to be capable of reducing the coal consumption of electric central station steam plants by 230,000 tons per annum for the entire country. A suggestion to advance the period of activity by one hour the entire year round, which is now attracting considerable attention, is estimated to afford about the same saving to the public in lighting bills, but to result in a somewhat greater saving of coal on account of the more favorable load factor for power plants which would result in the winter months.

Utilization of Water Power.—It is estimated that only about one-tenth of the available water power of this country is developed. Most of the remainder is in the western states. Much of it is remote from centers of population. All will require time for development after legislative impediments shall be removed. It is clear, however, that tremendous reductions in coal consumption may be effected in the future through further utilization of our water resources.

Elimination of Small Power Plants.—The inherently lower efficiency of small plants, together with the less expert operation which in general they receive, is estimated to be responsible for the use of one-third more coal than necessary. This element of waste is even more serious in England than in this country, as is evidenced by a recent report (April 16, 1917) of the Coal Conservation Sub-Committee of the Reconstruction Committee, in which, after pointing out that the average capacity of English generating plants is 5,000 h.p., it is stated that "The present coal consumption if used economically would produce at least three times the present amount of power."

Coal Saving Through Curtailment of Electric Light

It has been shown that the net reduction in the use of electric light which in the view of lighting experts it is desirable to make in the present circumstances of war and coal shortage is of the order of 7 per cent. of the total electric light produced. If a proportional amount of coal saving be assumed, this would mean a reduction in coal consumption of 840,000 tons per annum. This is the maximum extent to which it is saved through electric lighting curtailment. Such a saving compares with other possible annual savings as follows:

	Tons
Total saving which must be accomplished	50,000,000
Net saving thought desirable through curtailment of electric lighting	840,000
Saving if one degree lower temperature is adopted for building interiors, i.e., 69 degs. instead of 70 degs. F.	3,000,000
Saving if each family decreased by one shovelful its daily use of coal	15,000,000

The saving which is possible in the heating of buildings looms large. Our practice in this respect is to heat buildings to a considerably higher temperature than is done in Europe. The coal which might be saved by operating buildings at the temperatures which prevail in Europe instead of at the temperatures which we effect, would be more than the equivalent of the entire consumption of coal in electric lighting. Even the saving of one shovelful of coal per day makes any practicable saving through electric lighting curtailment seem very small.

This relatively small quantity of coal may be saved through curtailment of electric lighting at the expense of a certain amount of damage to business. The business of those who depend upon this form of advertising will suffer and the revenues of the lighting companies and of manufacturers of lighting appliances will be reduced. If it shall be decided that the best interests of the country demand that this relatively small amount of coal be saved at the expense of damage to business there is every reason to anticipate ready and unquestioning compliance on the part of those affected. In view, however, of the much larger savings of coal which may be affected in other ways it is to be hoped that the relative disadvantages of saving these 840,000 tons through lighting curtailment and through other means will be weighed most carefully.

As to accomplishing greater savings of coal through even more extensive curtailment of lighting it must be remembered that general reduction beyond the amount approximated in the cencensus given above would be at the expense of diminished safety, reduced production and impairment of vision. It would put in jeopardy the results of the work of this Society in bringing standards of artificial illumination up toward the place where the best interests of the public will be served. In the author's judgment such curtailment would be wise only if the coal shortage should become so acute that distinct impairment of the human energy of the country would be preferable to the use of the amount of coal involved.

Conclusions

The Fuel Administration in the performance of its tremendously difficult and delicate task has evidenced a desire to avoid damage to business wherever possible. At the same time it has rightly insisted upon economy in the use of fuel and upon the elimination of waste. While it appears that rather more attention has been devoted to the reduction of fuel consumption through the curtailment of light than the importance of this among the other means of saving coal would warrant, yet the lighting industry, like other business interests, has manifested a desire to do its bit cheerfully, and has sought to carry out the letter and the spirit of all regulations. The author's point of view, as stated in the introduction to this paper, is predicated upon the superlative importance of winning the war and upon the importance of economy as a means to that end. Accordingly this discussion has sought to emphasize all methods of curtailing the use of light which are believed to be promotive of ultimate economy and to be free from consequences which are of

Concluded on page 40)

Electric Railways

Steam Railways Use 25 Per Cent. of Total Fuel Mined—If Electrified This Could be Reduced by Two-Thirds—Great Economies Possible in This Direction

Mr. E. W. Rice, president of the General Electric Company, and also of the American Institute of Electrical Engineers, speaking of the coal shortage of the last two months and its relation to the development of our water-powers and the electrification of our railway systems, pointed not only to the saving that might be effected in coal consumption, but dwelt also on the greater capacity of our railways as at present equipped with rolling stock if they were operated by electric power instead of by steam. Much has been said about the saving to be made through cutting down our use of lights, which is responsible for something less than 2 per cent. of our total coal consumption, but Mr. Rice pointed out that our railways are consuming about 25 per cent. of the total coal mined, and that this is operating under such inefficient conditions that it requires 6 pounds of coal to produce 1 horse-power hour. It follows that if this equipment were replaced by electric traction with three times as high an efficiency, a saving of 16 2/3 per cent. of the total consumption of coal would be effected in one item—many times the possible saving if all our lighting systems were eliminated altogether. Some interesting extracts from Mr. Rice's address are given herewith:

We are now in the midst of an extraordinary coal famine, due to causes which it is unnecessary and perhaps undesirable for us to attempt to outline. However, I would like to point out in the first place how much worse the situation might have been were it not for the contributions of the electrical engineer and manufacturer; and, second, how much better our condition might have been if our contributions had been more extensively utilized.

Electricity in Coal Mines

Suppose we assume that the present serious situation is due to a lack of production of coal. It is comforting to consider to what extent conditions surrounding such production have been improved and how the amount of coal mined has been already increased by the use of electrical devices in connection with coal mining—such, for example, as the electric light, electric coal cutters, electric drills, and electric mining and hauling locomotives. I have no figures before me, but I think it is a fairly safe assumption that the amount of coal mined has been increased at least 25 per cent. on the average by the employment of such electrical devices. If this estimate were cut down to 10 per cent., it would still leave an increase in the tonnage of coal produced of something like 50,000,000 tons during the past year.

If, on the other hand, the difficulty is not due to a shortage in the production of coal, but rather to the failure of the distributive agencies of the country, it is interesting to see how this difficulty would have been largely removed if the railroads of the country were operated by electricity instead of steam. Where electricity has been substituted for steam in the operation of railroads, 10 to 50 per cent. increase in actual capacity of existing tracks and other facilities has been demonstrated. This increased capacity has been due to a variety of causes, but largely to the increased reliability and capacity, under all conditions of service, of electrical locomotives. This has enabled a speeding up of the train schedules by some 25 per cent., under average conditions. Of course, under the conditions which prevail in extreme cold weather, when the steam locomotives practically go out of business, the electric locomotives make an even better showing. It is, therefore, not too much to say that if the roads of the country were now electrified no breakdown of our coal supply, due at least to failure of distribution, would exist.

The terrors of these "heatless days" will not have been without benefit if they direct the attention of the people and of our lawmakers to the frightful waste of two of our country's most valuable assets—our potential water-power and our coal reserves. The first, potential water-power, is lost because it is allowed to run to waste, undeveloped, unused. The second asset, coal, is wasted for exactly the opposite reason. It is being used, but in a frightfully ineffective and inefficient manner.

The waterfalls constitute potential wealth which can only be truly conserved by development and use—millions of horse-power are running to waste every day, which once harnessed for the benefit of mankind become a perpetual source of wealth and prosperity.

A Tremendous Coal Waste

It is really terrifying to realize that 25 per cent. of the enormous amount of coal which we are digging from the earth each year is burned to operate our railroads under such inefficient conditions that the average of six pounds of coal is required per horse-power hour. The same amount of coal burned in a modern central power station would produce equivalent to three times that amount of power in the motors of an electric locomotive, even including all the losses of generation and transmission from the source of power to the locomotive.

Where water-power may be utilized, as in our mountainous districts in the West, all of the coal used for steam locomotives can be saved. In the Middle Atlantic States, however, water powers are not sufficient, and it will be necessary in a scheme of electrification that the locomotives be operated from steam-turbine stations.

We should not be justified in being so confident of the benefits of electrification of railroads if every element in the problem had not been solved in a thoroughly practical manner. The electric generating power stations, operated either by water or by steam turbine, have reached the highest degree of perfection, efficiency, and reliability, while the transmission of electricity over long distances with reliability has become a commonplace.

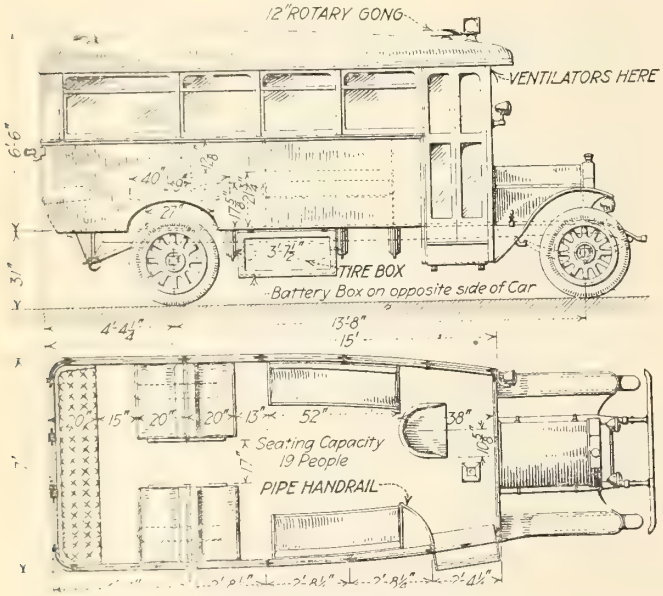
It may be said that the present is not a propitious time in which to deflect any of the country's capital into railroad electrification. I think that, in spite of the enormous advantages of which I have spoken, we should be inclined to agree

with such a point of view if it were not for the recent unpleasant demonstration of the apparent failure of our railroad transportation systems to meet the demands which have been placed upon them by the industries, aggravated, it is true, by the war conditions and also by the unkindness of the weather.

What assurance have we that the present conditions are temporary, and, even if they improve, as they surely shall with the coming of warm weather, what are we going to do next winter?

The Autobus as a Feeder for Electric Railways

While not in all cases satisfactory from a financial point of view, auto buses have proved very useful at many points in the United States where the transportation problem is urgent for consideration but where traffic does not yet warrant the extension of existing electric railways. In other words, as a choice between two alternatives the auto bus is the lesser evil. The Municipal Railway Company of San Francisco, on January 15, this year, put in service a bus system to serve as a feeder to one of its car lines from an outlying residential section. This is described by Mr. N. Eckart, railway engineer, San Francisco Board of Public Works, in the Electric Railway Journal. For the present the buses operate over two routes—one and two miles in length respectively. On both lines the route is paved, except for a half-mile of oiled macadam. Two buses maintain a ten-minute headway on the two-



Auto Bus used by Municipality of San Francisco

mile line, and a single bus runs on a fifteen-minute schedule on the other. The average speed is twelve miles per hour. Two buses are kept in reserve in case of breakdown among the other three.

The buses, which are arranged to seat 18 passengers and will carry as many more standing, are of the p.a.y.e. type, designed for one-man operation. They are mounted on White one-ton chassis, and are equipped with 37 x 5 in. pneumatic tires, single on the front and double on the rear. The buses are 15 ft. long, 7 ft. wide, and have a wheel base of 13 ft. 8 in. The weight, light, is 7,830 pounds. They are fully enclosed, with drop sash, and finished in harmony with the municipal electric cars. The cost was $5,624 each, fully equipped.

In the final acceptance test the performance was as follows on a run of 103.7 miles: Fuel consumption (gasoline at 9 cents per gallon, wine measure), 15 gallons, or 6.9 miles per gallon (the bid guarantee was 6 miles per gallon); total elapsed time, including 361 full stops of ten seconds each, eight hours and twenty-five minutes, or an average speed of 12.33 m.p.h. (the specifications called for 12 m.p.h.). The conditions of the above test were that the bus be loaded 4,000 pounds above standard equipment, and that the speed could at no time exceed 20 m.p.h. The test course was so selected as to represent average city conditions and included grades up to 10 per cent.

Quebec Railway Plans Campaign

At a meeting of the directors of the Quebec Railway, Light, Heat, and Power Company, held recently, plans were discussed for increasing the company's sources of revenue. Mr. W. J. Lynch, general manager of the company, outlined the plans, which consist of an extensive propaganda to advertise the company's power facilities with a view to enticing Western capital into the Province of Quebec, particularly on the company's lands in and around the city of Quebec, the idea in view being the furnishing of power to the industries backed by the capital so attracted.

The company has water-powers at Montmorency Falls, the Natural Steps just above the falls, at Chaudiere Falls, and on the Jacques Cartier and Ste. Anne Rivers. The total amount developed is 48,000 h.p., and there is stated to be further power available to the amount of 25,000 h.p., with an additional 3,000 h.p. when the proposed dam on the Jacques Cartier River is completed. At the present time the company has a surplus of 15,000 h.p. "With coal at prices ranging from $8 a ton up," said Mr. Lynch, "the cost per 24 hour h.p. is now about $76, as compared with $35 to $45 for electric power, according to the amount taken. The ever-increasing difficulties in the matter of coal supply also tend to throw a very favorable light on hydro-electric power, inasmuch as the manufacturer may contract from three to ten years ahead for his power and know exactly what it is going to cost him."

Mr. Lynch further stated that the company were going to conduct a vigorous electric heating campaign in the city of Quebec, from which a revenue of $700,000, at least, could be anticipated. Sir Rodolphe Forget, president of the company, is placing before the Dominion Government a proposal that the company electrify the new Quebec Bridge and take all trains across by means of electric locomotives. This would relieve materially the damage to the structure caused by smoke and steam from the coal locomotives. It was pointed out that it would cost the government more for painting the bridge under present conditions than would be paid to the Quebec Railway, Light, Heat, and Power Company for electric service.

The Winnipeg Railway Situation

At a recent meeting of the Winnipeg City Council, called to discuss the transportation question, Mr. Edward Anderson, K.C., solicitor for the Winnipeg Electric Railway Company, stated that the company is losing approximately $400,000 yearly owing to jitney competition, increase in operating costs, and so on. Expenses have grown from $1,369,000 in 1913 to $1,762,000 in 1917. In discussing the jitney question, Mr. Anderson pointed out that the city's contract with the company gave his clients exclusive right of transportation on the streets of Winnipeg, with the exception of that provided by animal-drawn vehicles. The contract called on the company to build and maintain a large proportion of the width of the streets. Further, the company had to keep this clear of snow. He pointed out that after a snowstorm it could be noticed that the only part of the road used by the jitneys was that cleared by the company's sweepers, and it was obviously unfair that they should have to clear the pavement to allow their opponents to operate. A serious financial crisis was averted in January only by personal guarantees of some of the directors. Mr. Anderson stated he understood there was not another large city on the American Continent where the jitneys have not been abolished or will be very shortly.

The Dealer and Contractor

Essence of Address Before the Toronto Electrical Contractors' Association, at Their Dinner, Thursday, Feb. 7, by H. A. Beach, credit manager, Northern Electric Company, Toronto

The rough pencil sketches used by Mr. Beach are reproduced herewith to facilitate the discussion which is to be continued on March 7.

The importance of an adequate and efficient accounting scheme, especially adaptable to the smaller contractor, has been, I believe, the subject of discussion in your association for quite some little time. On November 1 last, when I had the pleasure of addressing some of the members of this assemblage on a subject which I chose, as "The Relationship Between the Contractor and Credit Man," I felt somewhat flattered being asked at that meeting to lead a discussion on the matter of an accounting system for the smaller contractor. Since then an important court case has resulted in an amendment of the statutes, dealing with the "proper books of accounts," and, through the courtesy of the mailing department of your association, we have given you a copy, on a postcard, of this amendment. I am sure, in reading this over, you will realize now more than ever the absolute necessity and the importance of maintaining a proper set of books.

It was not anticipated, I am sure, by any one of the members that the proposal of a subject for discussion would have developed into one of such apparent interest, for the simple reason that to go into the matter as thoroughly as it necessitates would require quite some length of time. However, for the purpose of this meeting and considering the comparatively short time at our disposal, we have deemed it a matter of expediency to present this subject to you in the shape of diagrams, that you can all see, and which are facsimiles of the forms suggested.

I want to emphasize the expression of "suggested," as it was not my intention to present this as a matter of authority in any way, because we have undoubtedly with us to-night representatives of larger business, those especially who have outgrown the smaller system, and we expect they have profited by their experience in the kindergarten, so to speak, of electrical bookkeeping. Therefore, we ask for your honest criticism, and solicit your help in our demonstration.

Success Depends on the Operator

First of all we must attach importance to the fact that System means order, carefulness, and accuracy, or, in one phrase, a complete understanding of one's business and a definite knowledge of one's affairs at any time. In preparing these forms I have endeavored to keep foremost in my mind, as the principal features, the simplest competent method which is economical both in cost and labor saving. Of course, it is conceded that any system, no matter where it is employed, is to a great degree successful only by the operator.

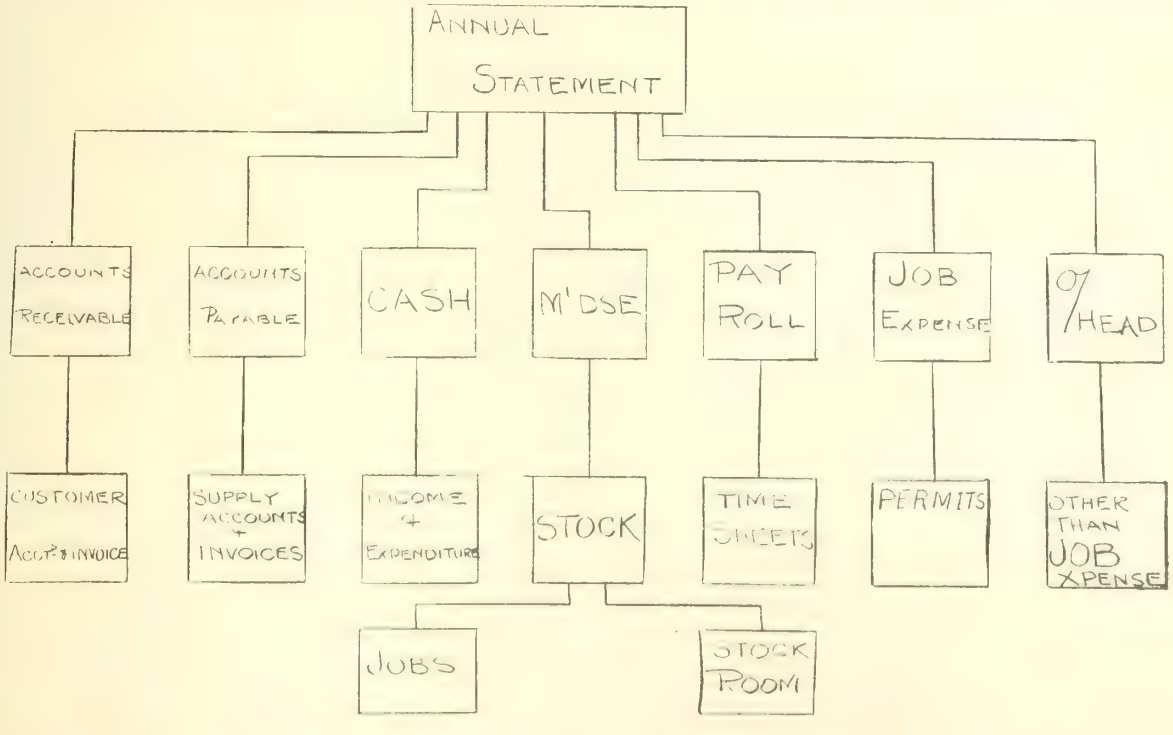


Fig. 1—Diagram illustrating the inter-relation of the various elements in the business to the annual statement.

DAILY CASH

		INCOME		EXPENDITURE	
DATE	DESCRIPTION	BANK	PETTY CASH	BANK	PETTY CASH

Fig. 2—Daily Cash Sheet, showing state of Bank and Petty Cash Accounts

It is bound to be affected and modified by local conditions, and must be adapted to suit the volume of work required and the time afforded. Inasmuch as these forms are all practical and self-explanatory, we will not spend too much time on the explanation of them, and will accordingly leave a more complete understanding of them to be gained in the different discussions.

However, some of the principal forms that we have used other than those of an ordinary accounting system are the "job and cost record" and "voucher form" (see forms herewith). In connection with the "job and cost record," you will note that we have prepared this form to suit general operations as we find them among local contractors. Its purpose is to give a complete detailed record and cost of each individual job. The intention is that the ruling will appear on both sides of the sheets, thereby enabling more than one form to be used, if necessary, on any particular job. The information shown on the right-hand lower corner are the particulars or "factor" as it is often referred to by manufacturing concerns, is generally added separately on both material and labor. We will leave this one form for another discussion.

I would next, just briefly, touch upon the operations covered by the voucher form. One of the principal duties of this form in connection with "accounts payable" is to eliminate the use of the journal and have this feature of the work performed by a voucher form. It is the intention, for simplicity's sake. to file all invoices in chronological order for each individual supplier, and, at the time of payment period, to summarize these invoices after they have borne their respective approvals and are in line for payment, on the voucher form, making a total of the recapitulation, which, of course, would be the amount of the cheque. This voucher form is forwarded with the cheque to the supplier, who receipts it in the space provided below and returns it to you for filing with invoices. This affords a complete transaction, accessible for ready reference. and posting can be made direct to the ledger, thereby

WORKMAN'S DAILY TIME CARD

NAME . 19

JOB No	TIME STARTED	TIME FINISHED	No OF HOURS	REMARKS
115	7	9	2	
182	8	12	3	
			5	

Fig. 3—Workman's Daily Time Card

of a rubber stamp, that can be purchased at a very nominal cost. The impression to be made on the last sheet for this information will give postings to the controlling accounts in the ledger. The line for profits is a matter open for discussion as to whether or not overhead expense, which, by the way, carries the overhead, other than the job expense. The "loading," saving duplication in posting to the journal. This is merely a simplified extraction of the voucher cheque method, with which you are undoubtedly all familiar with, but enables the use of cheques supplied by the various banks.

In order to devote for discussion the remainder of the time allotted to me, I think perhaps it is advisable to bring

JOB AND COST RECORD

ESTIMATE
CONTRACT PRICE
DATE STARTED _____ 18

CUSTOMER
ADDRESS
DATE COMPLETED _____ 18

JOB. No
APPLICATION No.
PERMIT No
FINAL CERT
DATE BILLED _____ 18

DATE	MATERIAL				LABOR										JOB EXPENSE		
	DESCRIPTION	QUANTITY	COST PER	AMOUNT	M	T	W	T	F	S	S	TOTAL HOURS	RATE	AMOUNT	CASH FOLIO	ITEM	AMOUNT
	Total Mats.															SUMMARY	
	" Labor															TOTAL MATERIAL	
	" Cost															" LABOR	
	" Profit															" JOB EXPENSE	
	Grand Total															" COST	
																" PROFIT	
																GRAND TOTAL	
	TOTALS																
	Cr Mtls Ret?																
	NET TOTALS																

Fig. 4—Job and Cost Record—Note Summary at lower right-hand corner

MDSE
CASH
A/cs PAYABLE
ETC ETC. ++

Mdse

No.

DATE	ITEMS	FOLIO	DEBIT	CREDIT	BALANCE ✓

Fig. 5—Ledger Sheet for both general ledger and individual accounts ledger

these general remarks to a conclusion, but before doing so I would like to propose one subject for discussion—the question of overhead expense and gross profits This, it seems to me, is one of the most vital points in your business to-day. It is surprising what little thought is given to it, for the simple reason, I believe, that a great many of us do not quite realize the proper basis for determining it. One authority goes so far as to say that nine-tenths of the retailers are making less than they think they are, and are always surprised when they find it out. If we can possibly devote a few moments to this question, which, you see, occupies a prominent role in this scheme, I am sure it will be well worth while for any information that may help even only one in our company here to-night. Just permit me to say, as we go over each feature individually, that we take it for granted that each one of you has an accounting method of his own, and this is not an attempt to enforce something on anyone present, but rather the idea is to offer a few helpful suggestions for your approval If one of you derives any benefit by its adoption, either in part or whole, we will indeed feel well repaid for any time that has been spent in its preparation.

Following Mr. Beach's explanation of the various forms, the members entered heartily into the discussion. It was found, however, that it would be quite impossible to co-relate

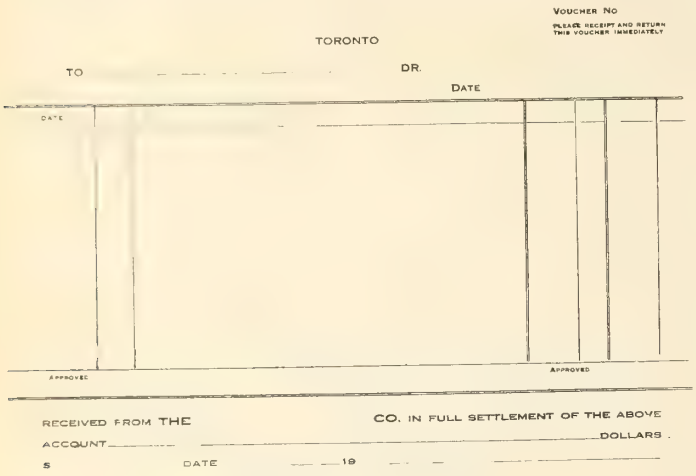


Fig. 6—Payment Voucher

the experiences of all the members at this one meeting, and it was decided that the program for the next meeting, on March 7, should be a continuation of the discussion. It is for this reason and in the hope that it will assist in a proper understanding of the scheme that we are reproducing herewith the six forms recommended by Mr. Beach. It should be distinctly understood that the experience and suggestions of every member of the association are urgently solicited to make the final forms as nearly perfect as is possible. It may be that further simplifications can be made.

The importance of some such system as outlined by Mr. Beach cannot be overestimated. In the interests of the electrical contracting business it is urged that every member of the association will give the matter as much thought in the meantime as possible, and come prepared, without fail, to enter into the discussion at the March meeting.

At the conclusion of the discussion Mr. Beach took occasion to bring to the attention of the members the following set of rules for figuring costs and profits, as recently recommended by the National Association of Credit Men. The suggestions are so good that they are well worth studying.

1. Charge interest on the net amount of your total investment at the beginning of your business year, exclusive of real estate.

2. Charge rental on all real estate or buildings owned by you and used in your business at a rate equal to that which you would receive if renting or lending it to others.

3. Charge, in addition to what you pay for hired help, an amount equal to what your services would be worth to others; also treat in like manner the services of any member of your family employed in the business not on the regular pay roll.

4. Charge depreciation on all goods carried over on which you may have to make a less price because of change in style, damage, or any other cause.

5. Charge depreciation on buildings, tools, fixtures, or anything else suffering from age or wear and tear.

6. Charge amounts donated or subscriptions paid.

7. Charge all fixed expenses, such as taxes, insurance, water, light, fuel, etc.

8. Charge all incidental expenses, such as drayage, postage, office supplies, livery, or expenses of horses and wagons, telegrams and telephones, advertising, canvassing, etc.

9. Charge losses of every character, including goods stolen or sent out and not charged, allowance made customers, bad debts, etc.

10. Charge collection expense.

11. Charge any other expense not enumerated above.

12. When you have ascertained what the sum of all the foregoing items amounts to, prove it by your books, and you will have your total expense for the year; then divide this figure by the total of your sales and it will show you the per cent. which it has cost you to do business.

13. Take this per cent. and deduct it from the price of any article you have sold, then subtract from the remainder what it cost you (invoice price and freight), and the result will show your net profit or loss on the article.

14. Go over the selling prices of the various articles you handle and see where you stand as to profits then get busy in putting your selling figures on a profitable basis and talk it over with your competitor as well.

[Note.—"The Electrical News" has been advised since the date of this meeting that already quite a number of contractors are making modifications along these lines. One contractor states he is adopting this scheme, and will report on its practicability to the association.]

Public Being Badly Educated

Manufacturers and dealers are doubtless bearing in mind the recent announcement of the Ontario Hydro Commission referring to the approval of material which will be required after the first of April. It is evident that there is to be a strong campaign launched by the commission with a view to eliminating the present hazards, which will undoubtedly be aggravated in the near future by the increased use of electric heaters and other thermo-electric devices. The commission considers that the general public has been badly educated along these lines in the past by certain indiscriminate advertising that heaters may be used on any key socket. Some of the best heater manufacturers, however, have assured the inspection department of the commission that they disapprove of this method of advertising, and will welcome a proper adjustment of the matter. We understand that the commision will not, in future, approve the apparatus of any makers who advertise that their products may be used in this way, and that a rule is being adopted making such practice an offence. This course is only fair to those manufacturers and dealers who have observed the spirit of the law in the past. It might be a good idea for manufacturers of heaters to get together and adopt a standard form of advertisement, so that the users of apparatus of this kind will readily understand the nature of the device they are using and how it should be used. Safeguarding the public is the wisest course in the long run, and for this reason the commision's move is to be commended. The best results will follow to all concerned if manufacturers, dealers, and contractors assist by a hearty co-operation.

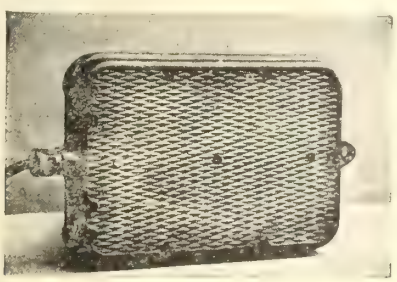
C.G.E. 1918 Fans

A novel feature of Canadian General Electric Company's fans for 1918 is in the finish, as all metal parts are now enameled a dark green, and the blades are lacquered brass. All of these fans are readily adjustable for either desk or bracket use. They are furnished with standard cords and plugs. The complete line of C. G. E. fans for this season will include 9-inch, 12-inch and 16-inch oscillating and non-oscillating four-blade fans in both direct and alternating current. Six-blade oscillating fans in 12-inch and 16-inch sizes are made for alternating current only. Ventilating fans for 1918 will be handled in 12-inch and 16-inch sizes, six blades, in both alternating current and direct current. These fans, finished in green enamel, with lacquered brass blades and trimmings, can also be furnished with special bearings to operate in a vertical position. In standardizing to three sizes of desk and ceiling fans the company's engineers feel that they have provided a fan suitable for every use.

The Hamilton-Beach cyclone universal fan for 1918, sold by the Canadian General Electric Company, is equipped with the H-B universal air-cooled motor, wound to operate on both direct and alternating current at a voltage of from 105 to 120, 60 cycles. This fan is equipped with a rheostat speed control, giving five different speeds and shutoff. It has an extra heavy base, which effectually prevents its creeping, and its design readily permits of its use either as a desk or wall-bracket type.

Foot-Warmer for Outdoor Service

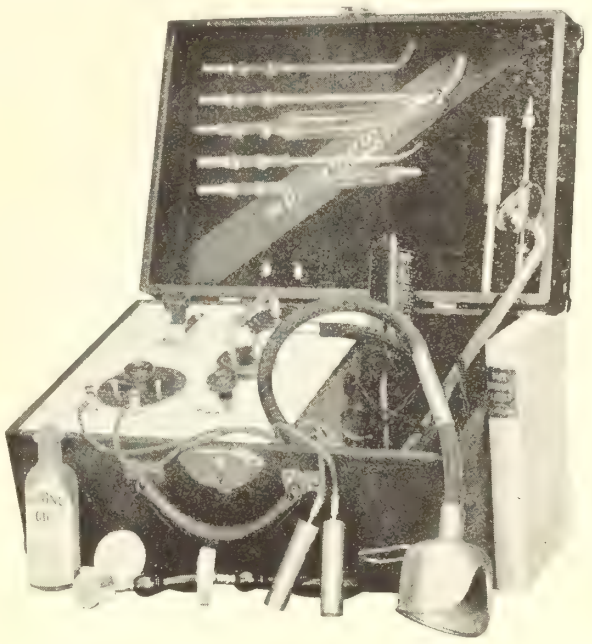
To minimize the discomfort of long standing outdoors in severe weather an electrically heated foot-warmer has just been placed on the market by the Westinghouse Electric and Manufacturing Company. While designed primarily for look-outs stationed in the bow and crow's nest of vessels, the device is applicable to the use of watchmen, sentries, doormen, traffic policemen, and others whose work requires them to be out of doors continuously with little chance for exercise. It has been found that if the rest of the body is adequately clothed, a foot-warmer will ensure comfort at any temperature. As will be seen from the illustration, the device consists of a casting 14 in. by 20 in. by 25 in., with diamond-tread top. This is of cast-iron, or of aluminum where non-magnetic qualities are desired, as in ship service. Against the under surface of this the heater element is clamped. The heater is



a slotted ribbon, clamped between two plates of built-up mica, so arranged as to give uniform distribution of heat. A sheet-steel plate fastened by screws and sealed with high-melting gum renders the entire unit waterproof. The resistance is divided into two parts, which may be connected to draw 200, 100, or 50 watts at 125 volts. A three-conductor cable seven feet long is provided. By using the lower heats in mild weather there is no danger of causing chilblains. It is felt that this heater will add greatly to the comfort, and hence to the efficiency, of men in exposed places, enabling them to do their highly important work of watching and guarding without the distraction of physical discomfort.

Branston Company to Launch National Campaign

The Charles A. Branston Company, Toronto, are putting on a national campaign in the electrical trade to make the period between April 8 and April 20 two "Violet Ray" weeks. Previous to and during this period they will launch a big advertising campaign and supply dealers with special window display and demonstration equipment. They have added several new sets to their line and claim that the Branston line of high frequency generators is now the most complete in Canada. The Branston Company have recently moved into their new factory and are now well prepared to take care of the increased business.



Square D Company Holds Annual Sales Convention

The first annual sales convention of the Square D Company, Detroit, Mich., was held at the Hotel Statler, of that city, January 10, 11, and 12, and was attended by all of their sales representatives from coast to coast, several advertising men prominent in the field, and members of the company's advertising and sales departments. Bryson D. Horton, president of the company, gave the opening address, which was followed by a talk on "The Industrial Plant," by A. MacLachlan, sales manager. L. D. Calhoun, advertising manager, spoke on "Industrial Advertising." Manufacturing and service problems were discussed at the Friday sessions, followed by a dinner at the Detroit Athletic Club in the evening, tendered by Mr. Horton. A trip of inspection through the factory on Saturday and a further discussion of safety switches, their manufacture, and features, concluded the program.

The A. C. Gilbert-Menzies Company

The A. C. Gilbert-Menzies Company has been formed for the purpose of manufacturing certain parts and assembling the A. C. Gilbert lines in Canada. The president of the new company is Mr. A. C. Gilbert with Mr. T. C. Menzies as manager. The new company will maintain the present G. A. Menzies sales and sample room at 439 King Street West, Toronto, and will, in addition, operate a factory for the manufacture and assembly of toys, "Polar Cub" fans, household motors, etc. The Canadian business of the A. C. Gilbert Company has grown rapidly in the past few years, and the present arrangement will allow greater scope for development.

Charles H. Keeling Goes With Square D Company

After years of experience in the electrical field, Charles H. Keeling has joined the selling forces of the Square D Company. He will work this company's Canadian territory, with headquarters at Toronto. Mr. Keeling first went into business in Ottawa, in 1907. For six years he was in the contracting business, and during this time he completed some of the

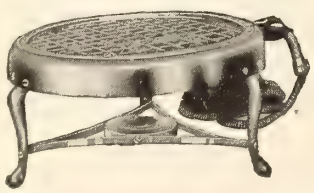


Mr. C. H. Keeling

largest electrical installations in that city. Prior to accepting his present position with the Square D Company, Mr. Keeling was connected with the Renfrew Electric Manufacturing Company, Ltd., at Renfrew, Canada. He was their first sales representative, and in 1916 was appointed sales and advertising manager of that company. After spending several days at the Square D Company's factory in Detroit to familiarize himself with their safety switch line, Mr. Keeling has returned to Ontario to assume his new duties.

Canadian Beauties for Coming Season

The Renfrew Electric Manufacturing Company are showing a very attractive line of household appliances which should prove to be good sellers during the approaching summer season. The company state that prompt shipment can be made of "Canadian Beauty" grills, toaster stoves, irons,



percolators, upright toasters, and so on. The "Canadian Beauty" 8-inch toaster stove is illustrated herewith.

The Eastern Electric Company

Messrs. Giddings & Sweetnam, Montreal have dissolved partnership, and Mr. C. D. Sweetnam has started business on his own account as the Eastern Electric Company, 131 St. Alexander Street, Montreal, wiring, poles, power plants, switchboard supplies, etc.

Malm, Gordon & Company

The firm name of Theo. Malm & Company has been changed to Malm, Gordon & Co. This is necessitated by the inclusion of Mr. W. G. Gordon in the firm. Mr. Gordon has been with the Canadian General Electric Company for a number of years in charge of their electric railway department.

Trade Publications

Condulet Suggestion—No. 6, by the Crouse-Hinds Company of Canada. This illustrates a system of lighting a textile mill using "Obround" condulets. The conduit system in this installation is supported by uprights fastened to the machines, which brings the system so low that it can be easily kept clean and lamps can be replaced without trouble.

Lighting Publications—The George Cutter Company, of South Bend, Ind., have issued an interesting bulletin, No. 3337, describing "Sol Lux" lighting reflectors and fixtures, schedule "H," effective January 21, 1918. The bulletin is well illustrated, and not only includes some splendid arguments on the value of good industrial lighting, but points out how this may be accomplished under greatly varying conditions. The same company are distributing bulletin No. 3338, describing Cutter "Universal" and "Standard" flood lighting projectors; also well illustrated and containing a quantity of engineering data on flood lighting projectors.

Spraco System—Bulletin No. 202, by the Spray Engineering Company, Boston, Mass. (Rudel-Belnap Machinery Company, Montreal, Canadian representatives), describing the Spraco system for cooling condensing water. In addition to a quantity of interesting illustrations of actual installations, with descriptions, the bulletin contains a number of tables showing results obtained with this cooling system on a typical winter day, a typical spring day, a hot summer day, and so on, all of which bear evidence to the splendid efficiency of the apparatus. An appendix also contains a partial list of Spraco cooling pond installations, which indicates the wide range of industries and territory covered by this company.

What Does Electric Illumination Cost?

(Concluded from page 32)

greater disadvantage than the advantage in coal saving which is effected.

If the least disadvantage to the prosecution of the war and to public welfare per ton of coal saved is accepted as the test governing coal saving regulation it is the author's opinion that other means of saving will be pressed more vigorously before lighting will be curtailed beyond the elimination of extravagance and waste.

Such coal as may be saved by the elimination of extravagance and waste should, of course, be saved, and our greatest efforts should be applied toward that end. It would seem, however, that the best way in which the public can assist in saving coal is to devote its attention to coal saving through improved heating, slightly reduced building temperatures, etc. With a given amount of effort and much less disadvantage, many times more coal saving can thus be effected than through curtailment of lighting.

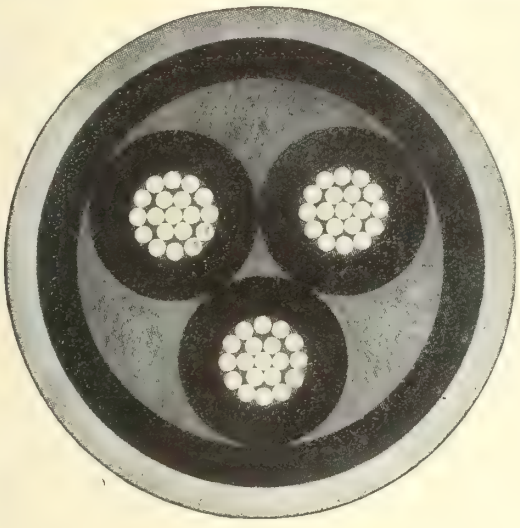
General curtailment of lighting would be a menace. For the last eleven years the Illuminating Engineering Society has devoted a large part of its effort to promoting good illumination. The research and investigation of its members on the effect of light upon the eye; the influence of its technical discussions upon design and installation of lighting appliances; its popular educational campaign in the fundamentals of good lighting have resulted in improvement of lighting practice especially in the more recent installations.

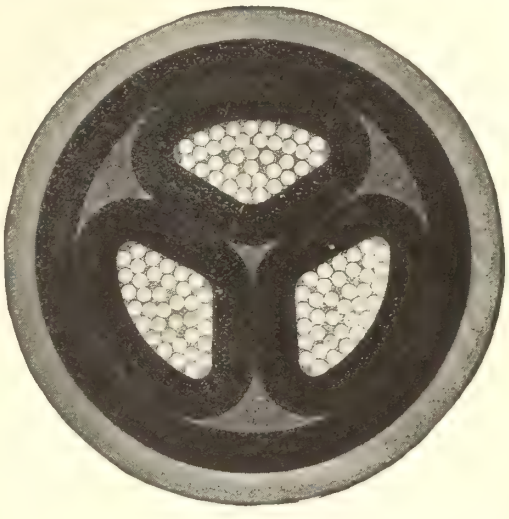
After careful consideration of this subject, including study of the statistics presented in this paper, the author has reached the personal conclusion that to curtail lighting generally would result in damaging the eyesight and impairing the efficiency of our people. He believes that the country cannot afford to incur such a risk for the sake of the small coal saving which may result—a saving which may be accomplished otherwise with much less disadvantage.

"Business as usual" is not our aim. War makes readjustment of business imperative. Economies must be effected.

PHILLIPS' CABLES

as supplied to the Toronto Hydro Electric System





These illustrations show cross sections in the original size of cables recently supplied to the T. H. E. System and reordered by them for further extensions. The specifications are as follows.—Conductors composed of 37 strands each, .082 in. diameter. Thickness of dielectric on each conductor, .210 in. Thickness in belt, .210 in. Thickness of lead sheath, .160 in. Overall diameter, 2.61 in., 250,000 C.M. Three Conductor, Paper Insulated, and plain Lead Covered Cable for 13,200 volts. We can supply you with wires and cables of any size for Power, Lighting, Telephone, Telegraph, etc.

Write us for detailed information.

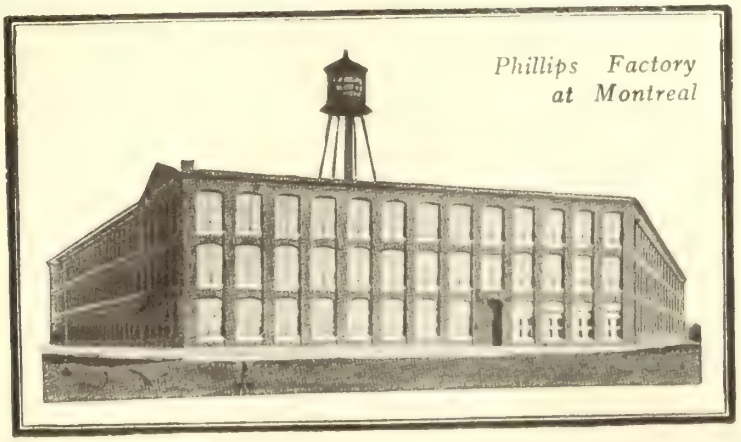
NOTE.—Specification of cable in left-hand cut: 3/0 B. and S. Three conductor. Each conductor 19 strands, each .094 in. diam. Thickness of dielectric on each conductor, .21 in. Thickness of dielectric on belt, .21 in.. Thickness of lead sheath, .15 in. Overall diameter, 2.60.

Specification of cable in right-hand cut: As stated in copy.

Eugene F. Phillips Electrical Works, Ltd.

Head Office and Factory: MONTREAL

Branches: Toronto Winnipeg Regina Calgary Vancouver



Phillips Factory at Montreal

Current News and Notes

Bassano, Alta.

The Town Council of Bassano, Alta., have placed an order for an electrically driven pumping unit, to be installed in the town waterworks.

Brockville, Ont.

An electrical contracting business is being established by Mr. A. P. Louch, of Brockville, Ont.

Chatham, Ont.

An equalizing scheme adopted in Chatham, Ont., for solving the power shortage consists in shutting off domestic circuits in the morning and afternoon, and factories, by agreement, operate only at certain periods of the day. Some of the factories operate at night only in order to still further relieve the situation.

The annual report of the Chatham Public Utilities Commission shows net earnings for the light department of $53,710, as compared with $34,914 in 1916. The net surplus is $119.

Halifax, N.S.

The Maritime Telephone Company, Halifax, N.S., contemplate the erection of a new telephone building.

The City Council of Halifax, N.S., have ordered plans prepared for a modern street lighting system. Tenders will be called shortly.

Melfort, Sask.

The Town Council of Melfort, Sask., have under consideration the installation of a modern switchboard in the electric plant and the construction of power line extensions.

Montreal, Que.

The Western Canada Power Company reports for December operating revenues $38,410, an increase of 1.8 per cent.; net earnings of $30,770, an increase of 22.1 per cent. Twelve months' operating revenues, $450,161, an increase of 20 per cent.; net earnings of $332,194, represent an increase of 28.1 per cent.

The Davies-Clayton Company, electrical contractors, Montreal, have registered.

Gross earnings of the Dominion Power and Transmission Company for the year ending 1917 amounted to $2,967,273, while operating expenses totalled $1,733,759. Net profits were $726,219, which added to the previous balance of $536,065 made the total surplus at the end of the past year $1,262,284.

Newmarket, Ont.

The Fire and Light Committee of Newmarket, Ont., have announced an approximate 10 per cent. reduction in light and power rates. The town secures power from the plant of the Toronto and York Radial Railway Company and the new rate will be 1½ cent per kw. h. on all current consumption over 25 kw. h.

Port Dover, Ont.

The Town Council of Port Dover, Ont., are negotiating with the Hydro-Electric Power Commission of Ontario in connection with securing a supply of Hydro power.

Pembroke, Ont.

The Pembroke Electric Light Company, Ltd., which will very shortly have sufficient power for all purposes, is undertaking a publicity campaign. Literature is being prepared setting forth the advantages the town offers for manufacturing purposes; local business men will be asked to circulate this matter by enclosing copies in their out-of town letters.

Regina, Sask.

A straight 5-cent fare has been adopted by the Regina municipal railway system. Tickets may be purchased, but there will only be five for a quarter. The price of labor tickets remains unchanged, although their use in the evening hours is prohibited. Children's tickets remain at the old price, 10 for 25 cents.

St. Catharines, Ont.

The annual statement of the St. Catharines Hydro-Electric Commission shows total earnings of $117,100, as compared with $78,814 in 1916. The net surplus for the year was $22,980. as compared with $10,423 in 1916.

Toronto, Ont.

The first prosecution in Toronto for failure to obey the power controller's order regarding window lighting was made a few days ago, the defendant being fined $50.

Personals

Mr. C. Barthe has been appointed superintendent of supply sales of the Canadian General Electric Company, Montreal, in succession to the late Mr. C. B. Ellis.

Mr. E. L. Milliken, manager of the Cape Breton Electric Company, of Sydney, N.S., since 1912, has accepted a similar position with the Houghton County Traction Company, in Northern Michigan. He went with the Cape Breton Electric Company in 1908 and served in various capacities until his appointment to the managership in 1912.

Mr. W. G. Gordon has resigned from the Canadian General Electric Company, with whom he has held the position of Transportation Engineer for over four years, and is entering into partnership with Mr. Theo. Malm in the Railway and Power Engineering Corporation, and in Malm, Gordon & Company, engineers. Mr. Gordon has had wide experience in connection with not only city and interurban electric traction, but also with trunk line electrification. After graduating from Cornell in electrical engineering in 1899, he entered the testing department of the General Electric Company at Schenectady. While in the railway construction department of this company he had charge of the installation of the first electrically operated train on the Manhattan Elevated, New York, and, later, of the installation of the first multiple unit equipments for the Northwestern Elevated, Chicago, Aurora, Elgin and Chicago Railway, Lake Shore Electric Railway, etc. Following this, while in the railway engineering department at Schenectady, he was closely associated with the further development of multiple unit operation for the New York Central lines and the Interboro Rapid Transit Company. For a number of years Mr. Gordon was in Australia in the General Electric Company's interests, where he was manager and engineer of the North Melbourne Tramways and Lighting Company, Limited; later engineer for the National Electrical and Engineering Company, Limited, handling the New Zealand business for the General Electric Company, and finally engineer for the Brisbane Tramways Company, Limited, until his return to Canada. He is a son of the late principal of Queen's University, Kingston, Ont., Rev. Dr. D. M. Gordon. He is a Fellow of the A.I.E.E. and is on the Traction and Transportation Committee of the Institute.

Railway & Power Engineering Corporation

Limited

MONTREAL
Power Bldg.
Tel. Main 5667

TORONTO
Can. Pac. Ry. Bldg.
Adelaide 2675

Railway, Light and Power Equipment

Let us quote you on the following Equipment and Supplies

WE REPRESENT

Bates Expanded Steel Truss Company
CHICAGO, ILL.
Steel Poles for Railway, Light and Power Purposes. Outdoor Type Substations.

Catskill Foundry & Machine Works
CATSKILL, N.Y.
Steel Gears and Pinions

Columbia Machine Works & Malleable Iron Co.
BROOKLYN, N.Y.

CAR EQUIPMENT

Armature and axle bearings
Armature and field coils
Bearings (bronze and iron)
Brush-holders and brush holder springs
Brake, door and other handles
Brake forgings, riggings, etc.
Car trimmings
Commutators
Controller handles
Forgings of all kinds
Gear cases (steel or malleable iron)
Grid resistors
Third-rail shoe beams and accessories
Trolley poles (steel) and wheels

TOOLS

Armature and axle straighteners
Armature shaft straighteners
Armature buggies and stands
Babbitting molds
Banding and heading machines
Car hoists
Car replacers
Coil taping machines for armature leads
Coil winding machines
Pinion pullers
Pit jacks
Signal or target switches
Tension stands

Special Shop Working Tools.

Laclede Steel Company
ST. LOUIS, Mo.
"Electroheat" Axle and Armature Shafts of all types and sizes. "Electroheat" Annealed side rods, main rods, crank pins, piston rods. All kinds of "Electroheat" Forgings, etc.

Morgan Crucible Company
NEW YORK
Carbon Brushes.

Railway Track Work Company
PHILADELPHIA
The Reciprocating Track-Grinder.

Westinghouse Electric and Mfg. Company
PITTSBURGH, Pa.
Trolley and Catenary Construction Material.

We also handle electric passenger, freight, and express cars and locomotives of all types and descriptions.

Keep this list before you whenever you are in the market for equipment and supplies.

All engineering service without obligation. List will be continued in next issue.

CITY OF CALGARY

Sealed tenders, marked "Tender for One Motor Generator Exciter Set," addressed to the City Commissioners, will be received by the undersigned up to twelve o'clock noon of Tuesday, March 12th, 1918.

Specifications can be received from

J. M. MILLER,
City Clerk.

5-5

CITY OF CALGARY

Sealed tenders, marked "Tender for One 750 Kilowatt Direct Current Street Railway Generator, Direct Connection to a Three Phase A.C. Synchronous Motor," addressed to the City Commissioners, will be received at the office of the undersigned up to twelve o'clock noon on Tuesday, March 12th, 1918.

Specifications can be received from

J. M. MILLER,
City Clerk.

5-5

For Sale Cheap

85 Kw. Westinghouse, 250 Volt, D. C. Generator, 750 R.P.M. First class condition. Write to

The KAUFMAN RUBBER CO., Limited,
Kitchener, Ont.

3-6



Generator Set Wanted

Wanted 35 to 50 K.W. 125/250 volt 3 wire D.C. Generator, direct connected to High Speed Engine. Write The Kaufman Rubber Co., Ltd., Kitchener, Ontario. 5-8

Generator and Motors For Sale

FOR SALE—One 250 KW. D.C. Generator, and six D.C. Motors, all 250 volt. Motors ranging from 15 to 100 H.P. All in good condition. Will sell cheap. Box 688, Electrical News, Toronto. 5-6

PETRIE'S LIST

of New and Used

MOTORS

for Immediate Delivery

No.	H.P.	Phase	Cycle	Volts	Speed	Maker
1	50	3	25	550	850	Westg.
1	40	3	25	550	750	C. G. E.
1	40	3	25	550	710	Westg.
1	25	3	25	2000	900	C. G. E.
1	20	3	25	550	1440	J. & M.
1	7½	3	25	550	1400	Westg.
1	7½	3	25	550	720	Westg.
2	7½	3	25	550	750	C. G. E.
2	5	3	25	550	1440	Excelsior
1	5	3	25	550	1400	Westg.
2	4	3	25	550	1400	Excelsior
2	3	3	25	550	1400	Excelsior
2	3	3	25	550	750	C. G. E.
2	2	3	25	550	1400	Excelsior
1	2	3	25	550	750	C. G. E.
1	1	3	25	550	1450	Excelsior

Write Us for Prices

H. W. PETRIE, Limited

Front St. West - Toronto, Ont.

NOTICE

IMMEDIATE DELIVERY

FOLLOWING

FIRST CLASS EQUIPMENT TO BE SOLD IMMEDIATELY AT VERY LOW PRICES

GENERATORS

No.	K.W.	Cycle	Phase	Volt	Speed	
1	100	60	3	550	900	($1500.00)
1	75	60	3	2200	900	($1500.00)
1	50	60	3	550	1200	($1000.00)
1	300	60	3	2200	600	
1	250	Dir. Current		250	425	
1	100	Dir. Current		250	600	
1	85	Dir. Current		250	800	
1	35	Dir. Current		250	400	
1	17	Dir. Current		250	1100	
1	20	Dir. Current		125	550	
1	17	Dir. Current		125	1100	
1	12½	Dir. Current		125	850	

MOTORS

5 to 100 H.P., 125 and 250 Volt, Direct Current.

5 to 300 H.P., 60 and 25 Cycle, All Voltages.

Transformers of all types.

Write or Wire if you are in the market to buy or sell equipment.

E. A. LOWRY

209 King St. - GUELPH, ONT.

VIOLET RAY

Campaign Weeks April 8th to 20th

The Branston Violet Ray — High Frequency Generator

Have a Violet Ray Campaign in your store during the two weeks of special selling, April 8th to April 20th. Our tremendous advertising campaign will create a bigger demand than ever for Branston Violet Ray Generators all over the Dominion. Thousands of Generators are now being sold and every one is an advertisement in itself. We realize this fact, and have proven that special demonstrations arouse a great deal of interest—Lead to many sales—Make satisfied customers—**Increase your profits.**

We are running full page advertisements in the leading magazines, calling attention to the Branston Violet Ray Demonstration in your store. If you are not at present a Branston Violet Ray dealer, write us today and get in on this.

We are preparing attractive complete Window Trims, Display Cards and Streamers, Lantern Slides for the Movies—Catalogs and Special Folders, Advertising Electrotypes for your local newspaper. —Every medium that will assure profitable results to dealers. It will make your store better known.

Reap the full benefit of the Campaign. Co-operate with us during this campaign. Put in a good window of Branston Violet Ray Generators. Use the window trim we supply you.

SPECIAL REDUCED PRICES ON OUR MODEL 7 GENERATOR FOR THIS DEMONSTRATION

Remember the Dates! Branston Violet Ray Weeks—April 8th to April 20th

WRITE TODAY FOR COMPLETE INFORMATION

Chas. A. Branston Co., 355 Yonge St., Toronto

MOTORS

FOR ALL CLASSES OF CURRENT

Large Stock Carried *Prompt Shipment*

WRITE OR WIRE US

We also Buy Used Equipment. If you have any to Sell write giving full particulars to—

The FISHER ELECTRIC CO.

43 Britain Street, TORONTO

3 Phase, 25 Cycle, 220 volt Motors

Immediate Delivery

No.	H.P.	Make	Speed	Type	Form
1	100	General Electric	500		
1	50	Allis-Chalmers	750		
2	50	General Electric	720		
1	50	General Electric	500	I	K
1	35	General Electric	750	I	K
1	35	General Electric	1500		
3	25	General Electric	750	I	K
1	20	General Electric	750	I	K
1	15	General Electric	750	I	K
6	10	General Electric	750	I	K
7	5	General Electric	1500	KT	C

3 Phase, 25 Cycle, 220 volt Motors

Ready for Delivery in March

No.	H.P.	Make	Speed	Type	Form
1	200	General Electric	500	I	K
1	150	Westinghouse	485		C
1	100	General Electric	750	I	K
2	60	General Electric	750	I	K
11	3	General Electric	1500	KT	
6	2	General Electric	1500	KT	

JOSEPH MYERSON

274 Commercial St. - BOSTON, MASS.

Mica Insulation

We manufacture everything, including:—
Tubes, Motor Rings, Washers, Built Up Plate
Flexible-Mica Cloth and Paper

Raw Mica (cut or uncut) **Ground Mica**

Mica Company of Canada, Ltd.

P. O. Box 156, HULL, Quebec

Selections from Our Stock of Motors

3 PHASE, 60 CYCLE MOTORS

Qu.	H.P.	Make	Volts	Type	Speed
2	½	G.E.NEW...	110	KT	1800
1	1	Fbks. M. ..	440	B	1200
1	2	Wstgh.	440	CS	1120
1	50	G.E.	220	M	900
2	3	R&M NEW.	220		1150
6	3	Wstgh. New	220	CS	1130
1	3	Cr.Wh.	220		1720
1	3	Fbks.M. ...	220	B	1200
2	2	G.E.	220	KT	900
4	3	G.E.	220	KT	1800
1	3	G.E.	220	KT	900
2	3	G.E.	220	KT	1200
2	5	G.E.NEW. .	220	KT	1800
3	5	Wstgh. New	220	CS	1130
4	5	G.E.NEW. .	220	KT	1200
2	5	Wstgh.	220	CCL	850
30	7	G.E.	550		1200
1	7½-15	Cr.Wh..	220/440		865/1735
5	7½	G.E.NEW. .	220	KT	1800
4	7½	G.E.NEW. .	220	KT	1200
6	7½	G.E.	550	KT	1800
2	7½	G.E.NEW. .	220	KT	900
3	10	G.E.NEW. .	220	KT	1800
1	10	Wstgh.	220	CCL	1700
1	10	Wstgh.	220	CS	1150
1	10	Cr.Wh. . ..	550	Q	1800
3	15	R&M	220		1150
4	15	Fbks.M.	220/440	KBV	1200
1	20	Cr.Wh..	220/440		1200
1	20	Triumph	220/440		900
2	20	Wstgh. . .	220	CS	1160
1	20	Fbks.M. . .	220	B	1200
50	20	Fbks.M.	220/440	KBV	1200
29	25	Wagner	220/440	BP	1120
1	25	G.E.	220	M	900
2	30	Wagner NEW	220		850
1	35	Triumph	220/440		900
1	35	G.E.	220	KT	600
1	35	G.E.	220	KT	720
1	40	Wagner NEW.	220/440	BP	850
1	40	Fbks.M. . .	220		900
1	40	G.E.NEW .	220	KT	1200
1	50	Triumph . .	220		720
1	50	G.E.NEW. .	220	KT	900
2	50	G.E.NEW .	440	KT	900
1	50	G.E.NEW..	220	KT	1200
2	75	G.E.NEW	220/440	K	900
1	125	G.E.	2200	L	600
1	150	Wstgh. New	440	CW	695
1	200	Wstgh. . .	2200	CCL	580
1	263	G.E. Synch. with direct connected exciter.	2200		600

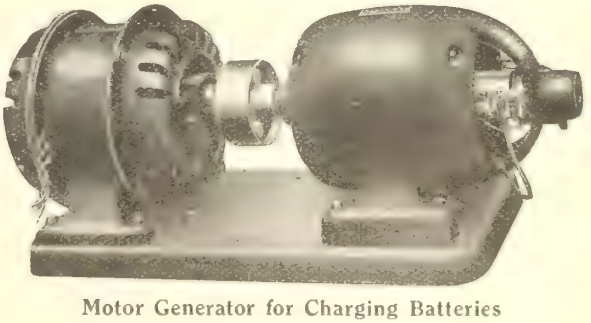
3 PHASE, 25 CYCLE MOTORS

Qu.	H.P.	Make	Volts	Type	Speed
1	5	G.E. . . .	220	KT	750
1	12½	G.E.elev.type high torque	220	KTE	750
1	15	Wstgh. . .	440	CS	730
6	15	Allis-Ch. ..	220		750
1	15	Fbks.M. . .	440	B	750
7	20	Allis-Ch. ..	220		750
2	20	G.E.	440	K	750
6	25	G.E.	440	K	750
1	50	Allis-Ch. intermittent duty, sl. rg. drum controller	440		500
1	55	Wstgh.sl.rg. 30 cycles, complete. .	440		860
1	60/45/30	G.E.	440	500/375/250	

GEORGE SACHSENMAIER & CO.

Office and Salesrooms: 141-43-45 N. Third Street.
Warehouses: 928-30-32 N. Third Street,

PHILADELPHIA



Motor Generator for Charging Batteries

Motor Generators

and all

Electrical Machinery

Write for prices and send your repairs to

Toronto & Hamilton Electric Co.

99-103 McNab St. N., HAMILTON Limited

REMEMBER TO

"Consult a Specialist"

A. H. WINTER JOYNER, LIMITED
TORONTO MONTREAL

New and Used
Electrical Machinery

Rewinding and Repairs Our Specialty

Maker	Volt	Cycle	Phase	H.P.
C. G. E.	220	60	3	35
C. G. E.	550	60	3	35
W. W.	550	25	3	15
J. & M.	550	25	3	15
J. & M.	550	25	3	20
Lancashire	550	25	3	10
Marelli	550	25	3	5
Westinghouse	550	25	3	5
B. G. E.	550	25	3	25

Air Cooled Transformers Built to Order

Electrical Engineering Co.
of Toronto
122 Wellington St. West
TORONTO

The famous "Drop-Out" Renewal Link can be had only in
ECONOMY renewable FUSES

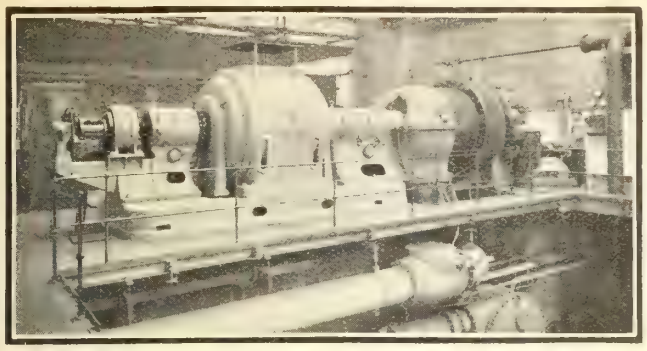
This link is responsible for the saving of 80% of the annual fuse maintenance cost.

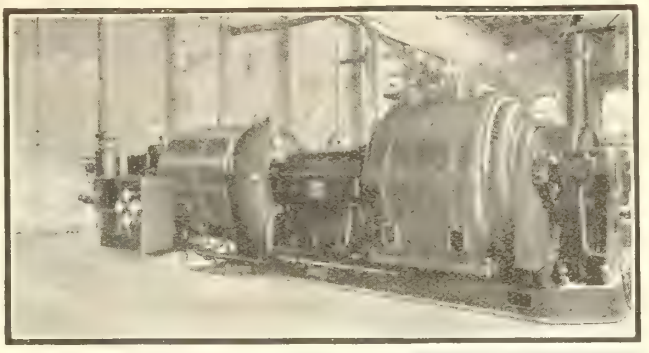
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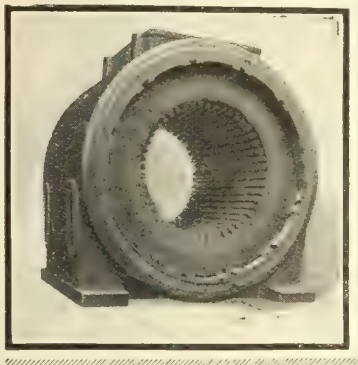
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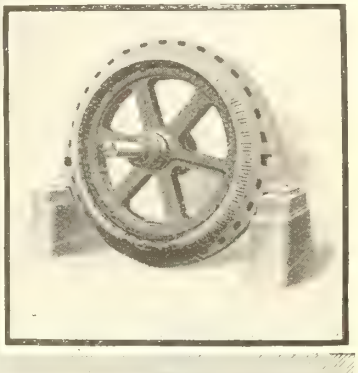
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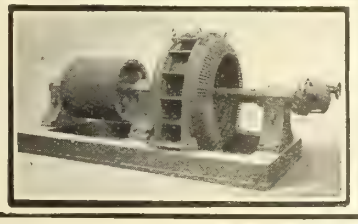
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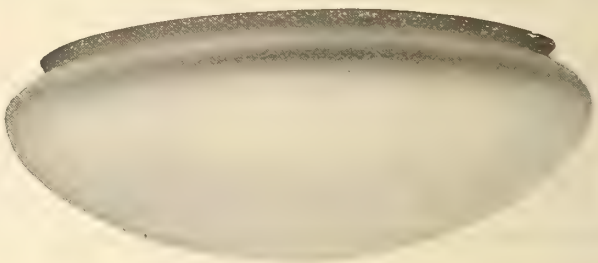
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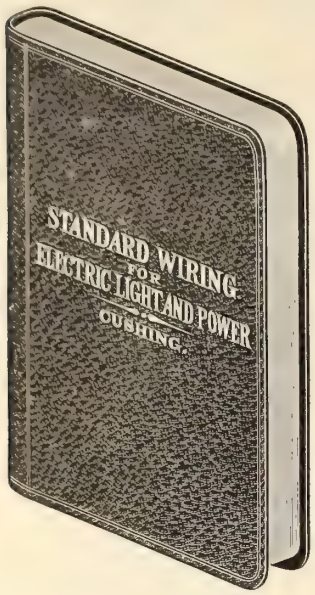
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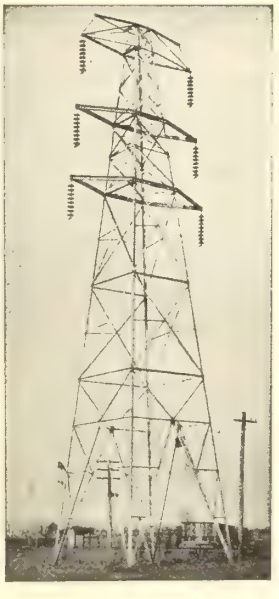
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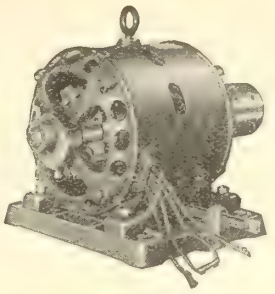


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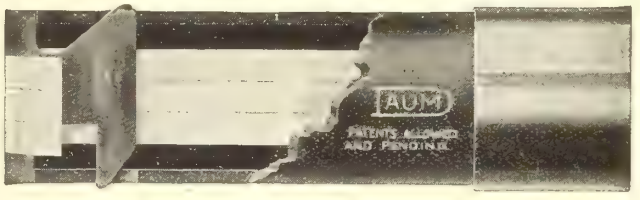
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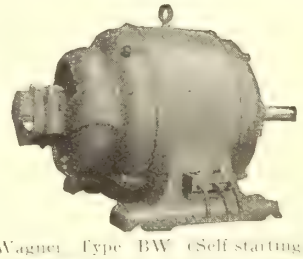
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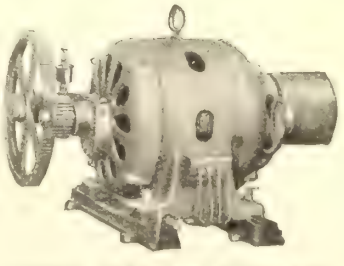
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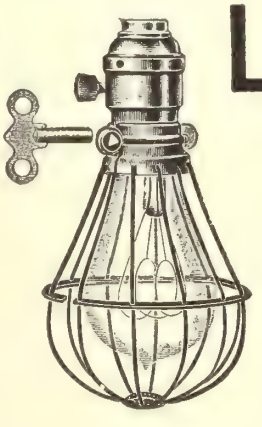
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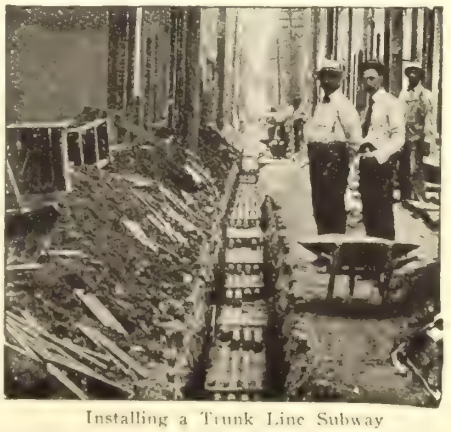
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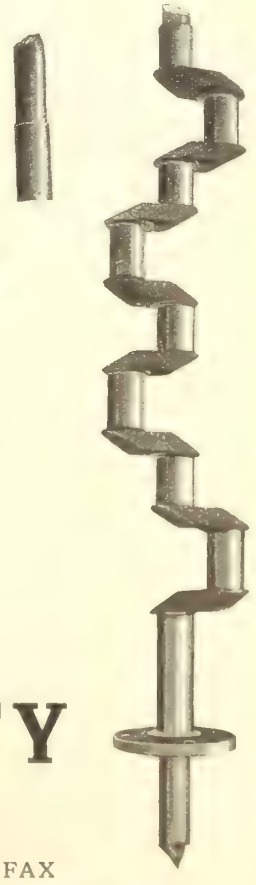
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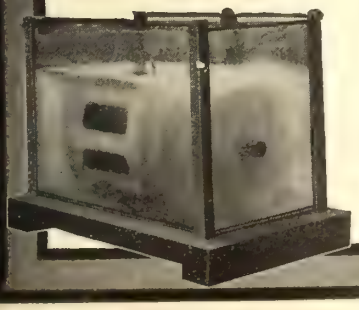
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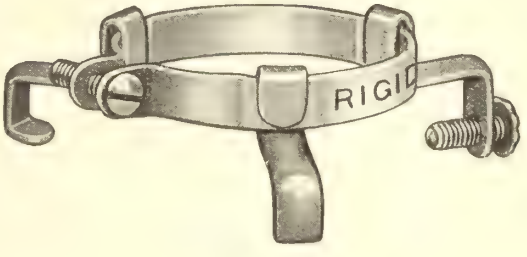
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Practically indestructible, few parts, no delicate pieces, efficient, long life, monoplane heating element.

Radiation from top prevented by dead air space, all heat given off at ironing surface.

A heat storage pla te stores the heat not being taken by the ironing surface making the iron stay hot longer.

The weight, 6¾ lbs., makes heavy ironing easy, but is balanced so nicely that the finest lingerie is ironed with ease.

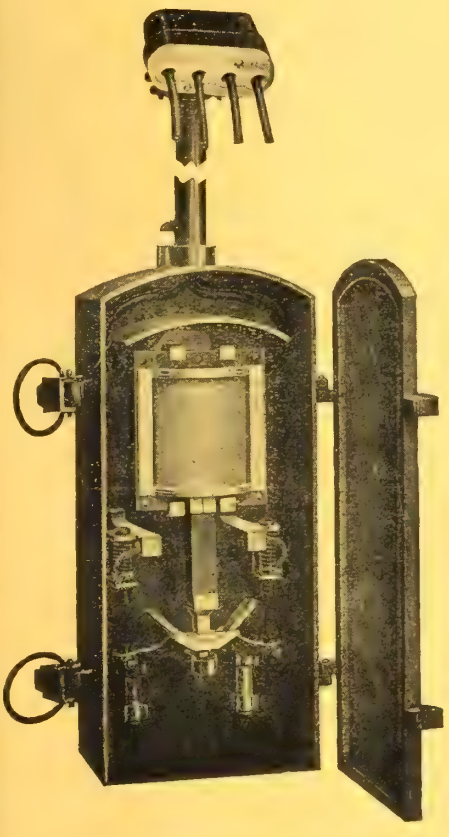
The handle fits the hand, and is so sloped that it takes the strain off the wrist.

The attached stand enables you to turn the iron upside down and use it as a hot plate.

This is the Most Satisfactory Iron to Handle.
Ask Our Nearest Office for Full Particulars.

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Orders are received from all the Provinces.

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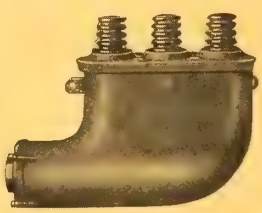
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Are made in all Sizes, Shapes and Voltages

Five styles of construction in twelve shapes give an almost unlimited range of selection. Any size of cable or conduit can be fitted. Terminals either detachable or non-detachable.



Type "P" Flat Pothead



Type "N" Elbow Pothead



Type "Q" Porcelain Pothead



Type "N" Abutting Pothead



Type "N" Edgewise Pothead

Supplement "B" illustrates various shapes clearly. Mailed upon request.

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Vol. XXVII No. 6 Toronto, March 15, 1918

Electrical News

Generation, Transmission and Application of Electricity

The Best
flexible, non-metallic conduit
comes in boxes. There's only one.



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Northern Electric paper insulated lead covered Power cables are designed, manufactured and tested to maintain the highest possible factor of safety.

In every phase of their production, engineering skill of the highest order directs their manufacture.

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Among all rubber covered wire "Adanac" enjoys the largest sale in Canada. The carefulness and skill with which this wire is insulated secures a degree of safety in excess of underwriters' requirements.

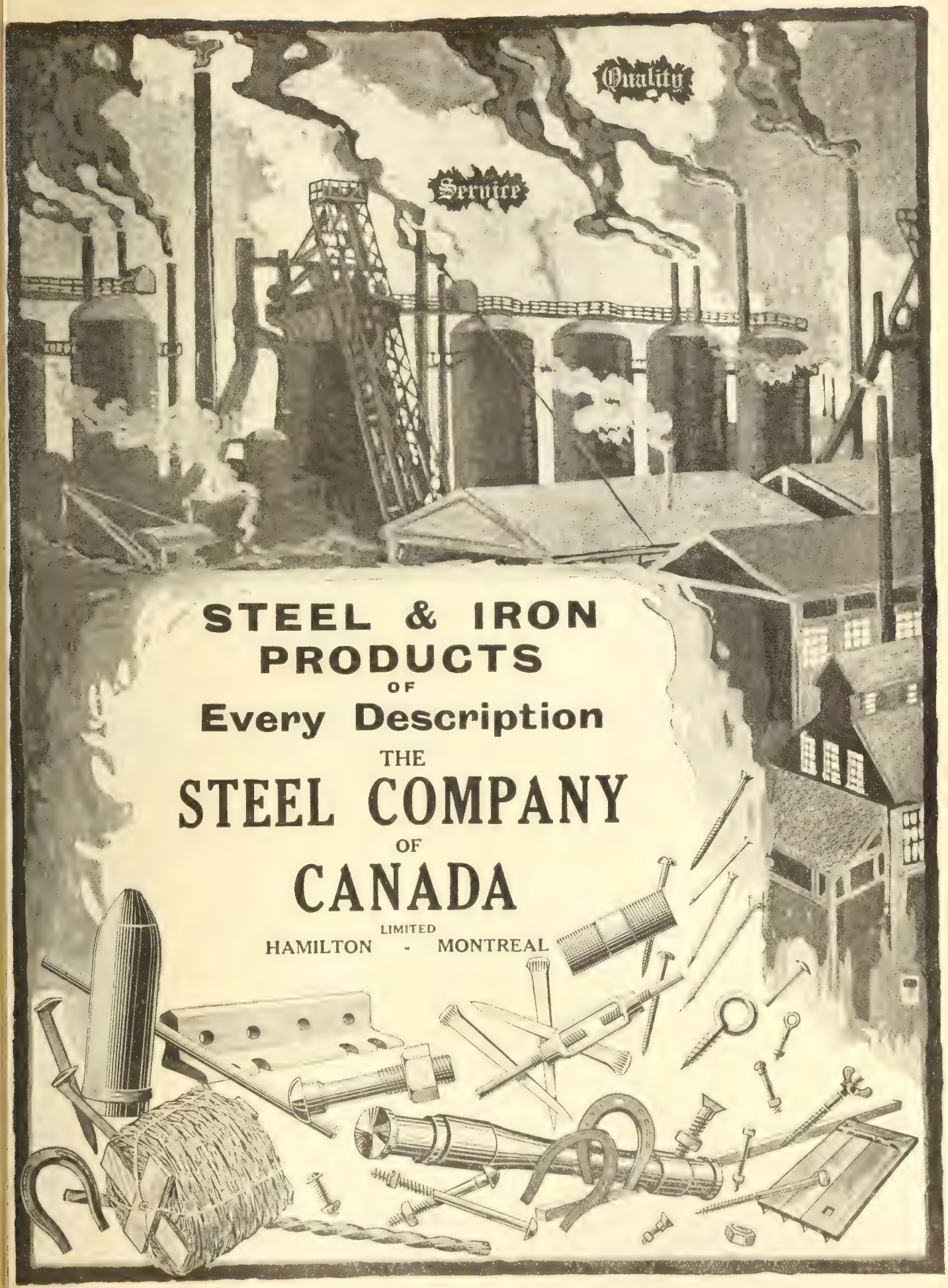
Enquiries as to specifications and prices are welcomed at any of our branch houses.

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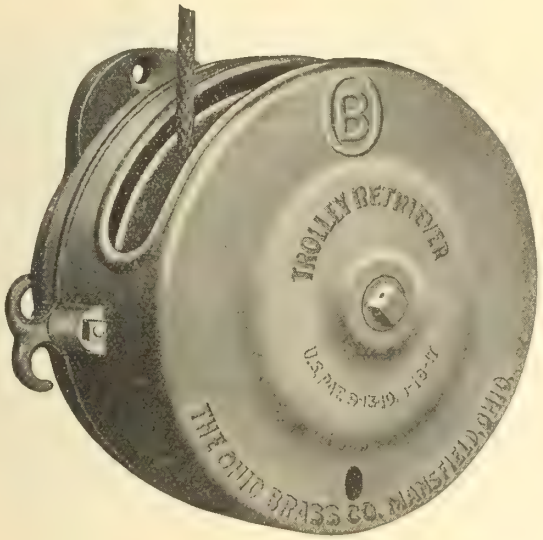
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A "wild" pole can do a great deal of damage to overhead construction. This danger is minimized, however, if the cars are equipped with O-B Catchers or O-B Retrievers.

The Catcher is for city service. It catches the pole when it leaves the wire and holds it safely. It keeps the rope reeled in and prevents it from dangling dangerously.

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Plenty of rope-room is provided, so the trolley rope cannot foul in wet or snowy weather.

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Ask about a trial on your own cars

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MANSFIELD, OHIO

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As a matter of fact Lincoln Arc Welders used in manufacture of metal products are frequently making even greater savings than in repair work.

Lincoln Arc Welders

are especially adapted to fabricating iron, steel, and other metals—welding seams, fastening on attachments — joining of parts—in fact, any work of this nature on which speed and economy count. The heat from the Lincoln Arc can be concentrated on a small surface, giving a clean looking job and preventing the warping or buckling usually encountered in gas welding.

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Our Welding Engineer will gladly inspect a plant and product for welding possibilities—at no cost to the owner.

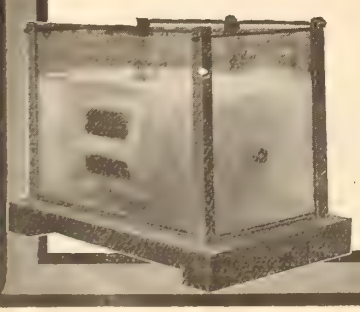
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Stability and Efficiency

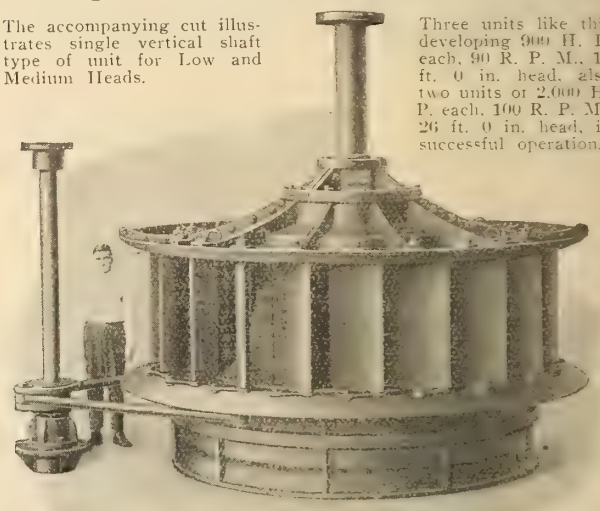
are prime factors in development of Water Power in these days of intense activity. That's why

SMITH HYDRAULIC TURBINES

are being installed in the "PLANTS THAT COUNT"

The accompanying cut illustrates single vertical shaft type of unit for Low and Medium Heads.

Three units like this developing 900 H. P. each, 90 R. P. M., 15 ft. 0 in. head, also two units of 2,000 H. P. each, 100 R. P. M., 26 ft. 0 in. head, in successful operation.



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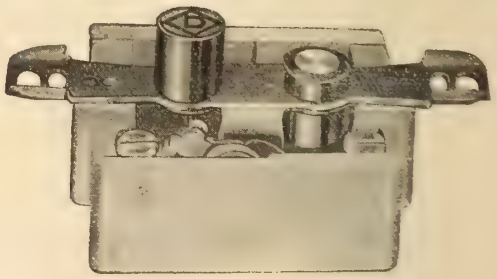
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Shallow Type—Superb Action

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No. 200

Three Way
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Easy to Install—
Price is Right

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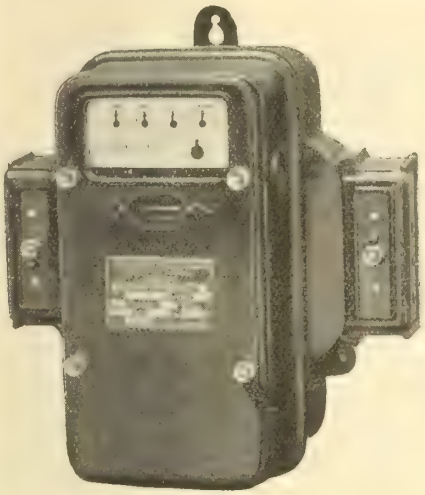
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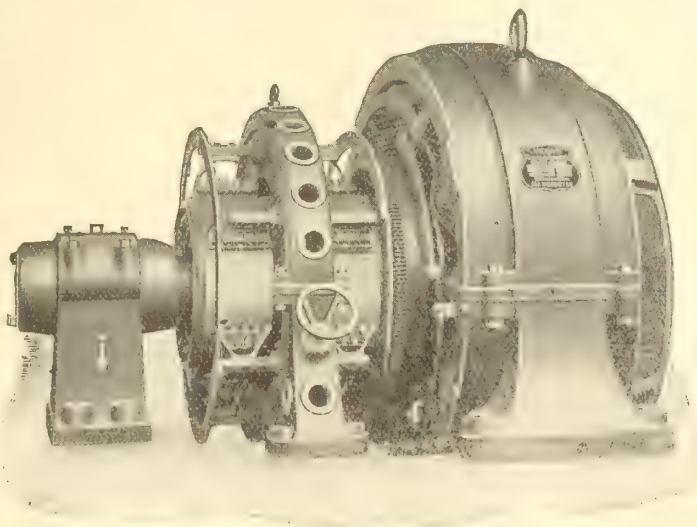
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1000 H.P. Variable Speed Motor for Direct Coupling to Tyre Rolling Mill.

Accidents will happen, but a complete stock of spare parts and well equipped repair shop ensure users of "Lancashire" machines, minimum inconvenience from such breakdowns.

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"GALVADUCT" and LORICATED

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Recognized as the standard of high quality.

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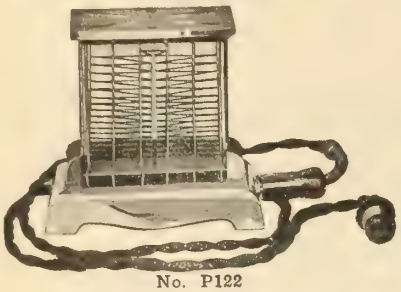
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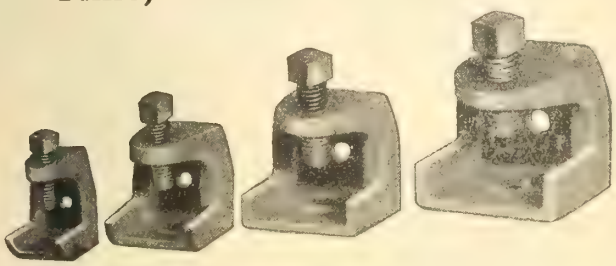
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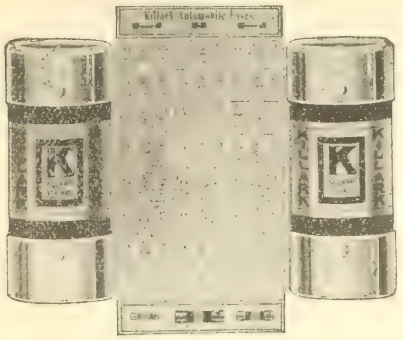
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The right fuse for every make of car and motor cycle

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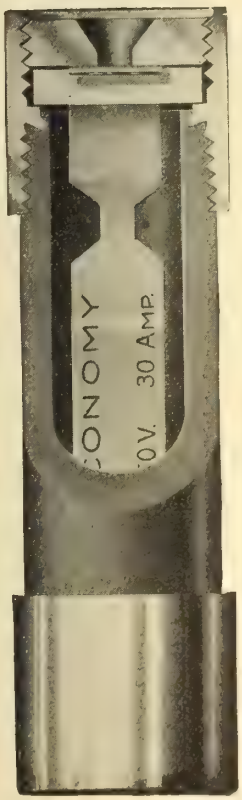
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Electrical Merchandise **120 Liberty Street, NEW YORK**

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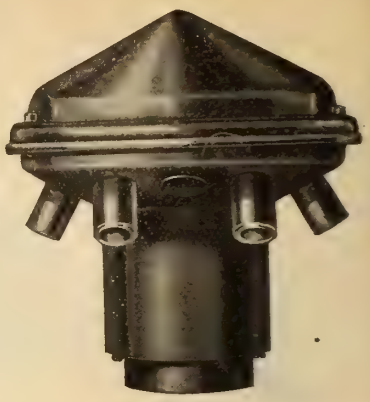
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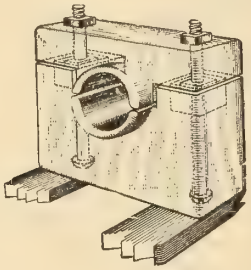
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"FRANKLIN" Cable Potheads
For all conditions. Require no wiped joint.
Switchboard Cleat Insulators
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To secure prices give us K. W. capacity, voltage, cycles, transformers required.

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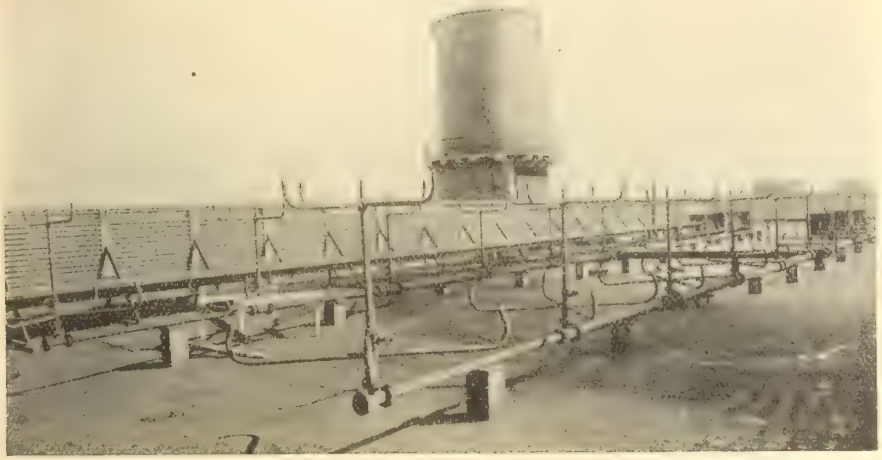
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Ford uses "Spraco" equipment

Ford Motor Co. efficiency experts install additional Spray Cooling Ponds



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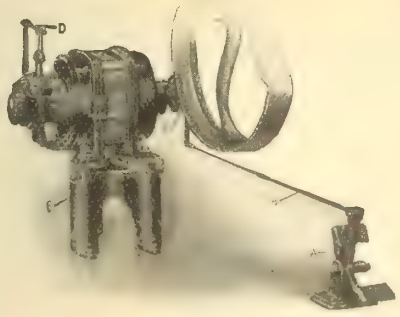
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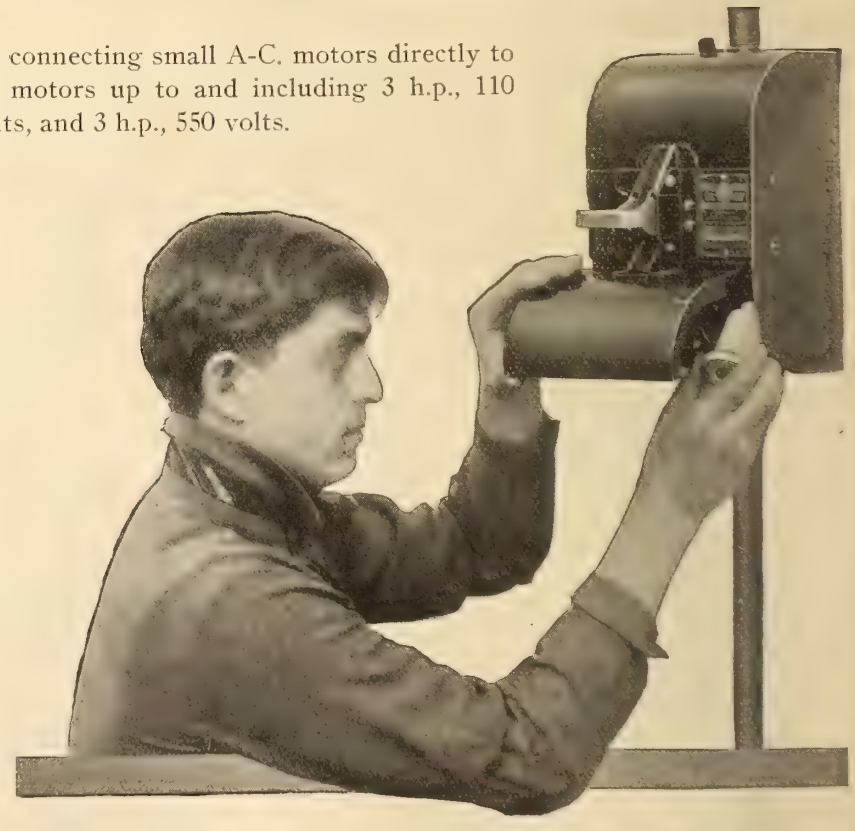
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1038 MOTOR STARTING SWITCH

The CR-1038 Switch is used for connecting small A-C. motors directly to the line, and is suitable for use with motors up to and including 3 h.p., 110 volts; 5 h.p., 220 volts; 3 h.p. 440 volts, and 3 h.p., 550 volts.

You Can Replace the Fusible Link in a Minute on this New A-C. Motor Starting Switch

A new type of protective plug guards the motor against continued overloads, but does not open the circuit under ordinary starting or momentary overload conditions. The protective element in the plug is easily renewed without tools and at a remarkably low cost. A sensitive protection is thus provided for the motor at a negligible cost.

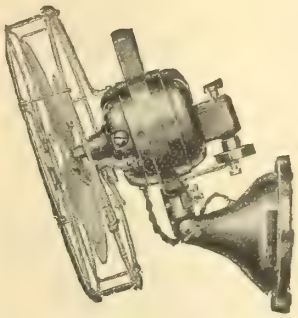


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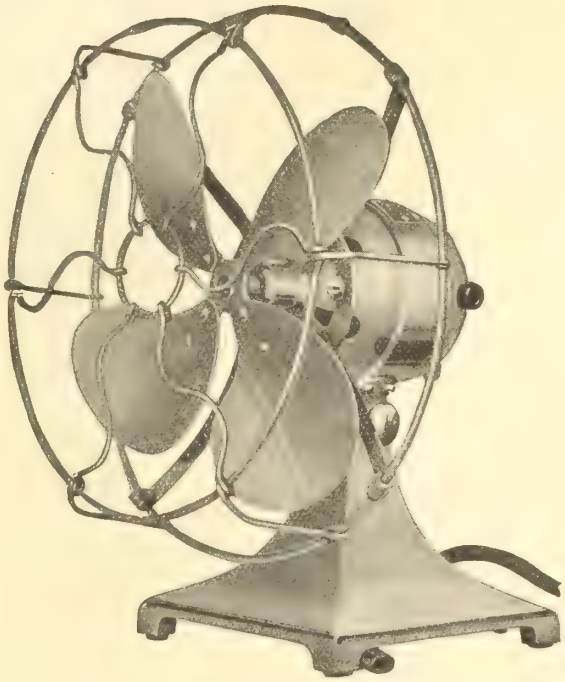
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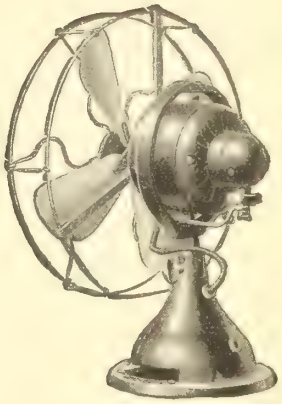
1918 ELECTRIC FANS 1918



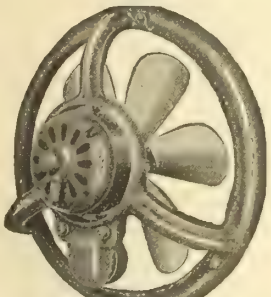
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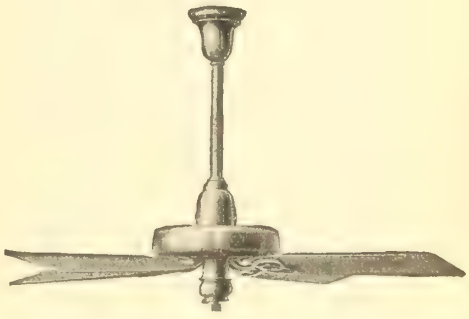


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56 inch Ceiling Type A.C. and D.C.

The full line comprises 9 inch, standard and oscillating; 12 and 16 inch standard, and oscillating; ceiling fans; and exhaust fans. Write our nearest office for prices.

IMPORTANT—Order early to insure prompt delivery.

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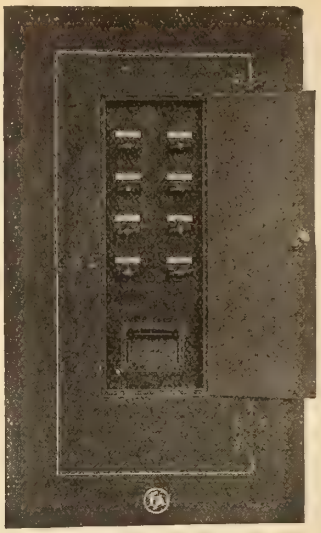
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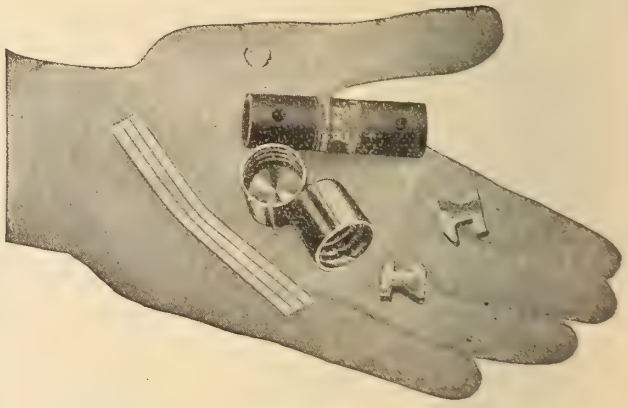
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FOR ELECTRIC LIGHT AND POWER

Always were the simplest fuses in construction on the market. The new Type "B," Form 4, has been reduced to the fewest parts—four metal parts of solid brass, a fibre shell and the fuse strip. Caps are removed by a twist of the wrist and as easily tightened, holding the fuse strip in intimate metal-to-metal contact.

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THE perfect balance of the Robbins & Myers Fan is a feature which contributes greatly to its smooth, quiet operation and long life.

You can operate an R & M Fan in any position you wish, and it will run smoothly, noiselessly and without vibration.

Every fan is balanced carefully by an expert before it leaves the factory, to make sure that it will operate in all running positions without vibration. It is this attention to every detail which makes R & M Fans so well liked by users and so profitable for the dealer who sells them.

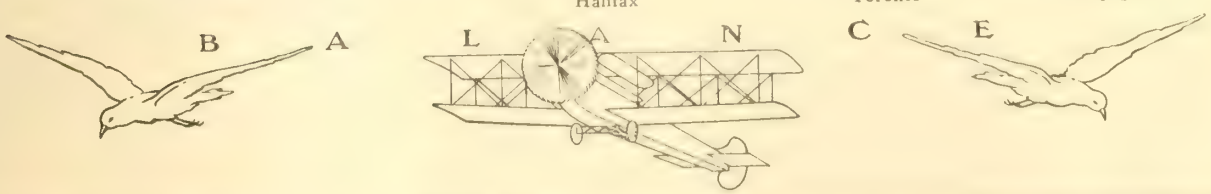
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Demonstrate the Branston Violet Ray Generator in your store

During the two weeks of special selling—APRIL 8th to APRIL 20th—our tremendous advertising campaign will create a bigger demand than ever for Branston Violet Ray Generators all over the Dominion. Thousands of Generators are now being sold, and every one is an advertisement in itself. We realize this fact, and have proven that special demonstrations arouse a great deal of interest—lead to many sales—make satisfied customers—**increase your profits.**

In March and April, with the breaking up of winter, come slushy streets and muddy roads, cold, raw winds. It's the time of colds, coughs, neuralgia, rheumatism, neuritis, headache, earache, and backache—the time when every ache and pain in your town means a prospective purchaser of a Branston Violet Ray Generator, the most wonderful scientific discovery of modern times for the relief of pain and the cure of diseases. Used, endorsed, and recommended by the most prominent Physicians, Hospitals, and Sanitariums throughout the country.

Violet Ray

CAMPAIGN WEEKS April 8th to April 20th

If you are not a Branston Violet Ray dealer write us to-day and get in on this.

We are running full-page advertisements in the leading magazines, calling attention to the Branston Violet Ray demonstration in your store. We are preparing attractive complete window trims, display cards and streamers, lantern slides for the movies, catalogues and special folders, advertising electrotypes for your local newspaper. Every medium that will assure profitable results to dealers is being utilized.

Reap the full benefit and co-operate with us during this campaign. Put in a good window of Branston Violet Ray Generators. Use the window trims we supply you.

Special Reduced Prices for this demonstration.

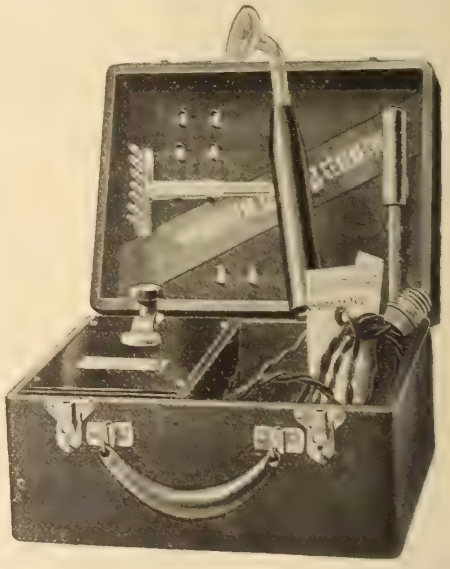
Remember the dates—Branston Violet Ray Weeks, April 8th to April 20th.

Write to-day for complete information.

SPECIAL REDUCTION

This $40.00 Generator special retail price $34.50

The Model 7 Branston Violet Ray High Frequency Generator regularly sells for $40.00. But during this introductory campaign only the retail price has been reduced to $34.50.



This machine is designed for general all-round family use, for which it will be found eminently practical. It is put up in an attractive and durable leather-covered, velvet-lined case, 12 x 9 x 6½ inches, complete with connecting cords, one No. 1 surface electrode, No. 2 metal electrode and No. 4 Comb electrode.

Chas. A. Branston Co.

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355 Yonge Street, TORONTO

Electrical News
Generation, Transmission and Application of Electricity

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Subscribers are requested to promptly notify the publishers of failure or delay in delivery of paper.

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Vol. 27 Toronto, March 15, 1918 No. 6

Hydro-Electric Development Should Be Pushed Forward

Whatever expenditures may or may not be justified at the present time there seems to be no question either in the minds of the electors or of the members of the local legislature that the Hydro water-power development work must go forward. This is evidenced by the amount of something over nine million dollars which appears in the Ontario estimates for the coming year.

Though this, at first thought, may seem a too heavy expense under present conditions, it is well to consider that, in view of the fuel situation, it is an emergency necessity. Nor is it entirely impossible to figure it out as a good investment. Let us suppose that every two hundred dollars expended by the Commission in construction work delivers one continuous horsepower for one year; the total sum is equivalent of 45,000 h.p. years, the value of which varies depending upon the use to which it is put. On the basis of B.t.u's it is the equivalent of about 37,000 tons of anthracite coal, which, at ten dollars a ton, is worth $370,000, and represents a return of slightly over four per cent. If the developed water-power were used for heating purposes this would probably represent somewhere near its value.

Going to the other extreme, however, it is frequently stated that at the efficiency of the steam railway engine it requires seven pounds of coal to produce one kilowatt hour. On this basis the 45,000 h.p. years is the equivalent of approximately one million tons of coal with a value of, say, $10,000,000. Of course, before this power can be utilized on the railways there must be an expenditure of many millions in equipment. The fact remains, however, that, cheap or expensive, water power is, up to a certain point, a substitute for coal, and since our coal supply is threatened it would be unwise to neglect to develop the water falls. The same argument applies to the St. Lawrence and numerous other powers. When people are freezing to death they are not apt to haggle over the price of heat.

Needless Waste of Fuel Hinders Conservation

Following a paper by Mr. John Blizzard, B.S.Sc., on the subject, "Availability of Energy for Heat and Power," presented before the Ottawa branch of the Canadian Society of Civil Engineers; Mr. Edgar Stansfield, M.Sc., chief engineering chemist of the Mines Branch of the Department of Mines, submitted a number of recommendations. Mr. Blizzard's remarks and recommendations have particular reference to the unnecessary waste of fuel due to waste of by-products and the inefficient operation of steam railways and power-generating plants. These recommendations are as follows:

Fuel Recommendations

That a Dominion board of energy commissioners be established, somewhat on the lines of the Board of Railway Commissioners, and that this board be given wide powers.

That the board consist of mechanical engineers, electrical engineers, and chemists, the best men available in their respective spheres, having not only high scientific and technical ability but imaginatoin.

That the board be given investigative, advisory, and restrictive powers:

Investigative power to carry out such laboratory and large scale investigations as are necessary for the efficient utilization of our resources; the scope of the investigations to include the winning and marketing of fuels and their by-products, as well as the development and employment of power and heat.

Advisory power to furnish the best advice and most up-to-date information, including recommendations as to new developments, improvements of old plants, consolidation of power plants, and the co-operative establishment of allied industries.

Restrictive power to prohibit the inception of needlessly wasteful schemes, and to compel the improvement within a term of years, where such improvement can be shown to be commercially practicable, of all established, needlessly wasteful, processes.

Extracts from Mr. Blizzard's paper are also reproduced elsewhere in this issue. The recommendations are being submitted to the council of the C. S. C. E. at Montreal.

Interesting Talks Before Montreal Electric Club

One of the brightest talks of the season was given by Mr. M. P. Fennell, secretary-treasurer of the Montreal Harbour Commissioners, at the Montreal Electrical luncheon on March 6. The subject, "Canadian Ports and their Relation to Transportation," does not sound particularly lively, but Mr. Fennell made it of more than usual interest, and narrated many facts in a manner that compelled attention. The speaker has visited all the great ports of the world, and was thus able to speak with first hand knowledge of his subject. He first alluded to the fact that it was intended in the near future to entirely electrify the harbour of Montreal. After defining a port and a harbour, he pointed out that three factors largely determined a harbour—the potentiality of the tributary commerce, size and accessibility, and the develop-

docks. In Canada the interior tributary trade from the northwest, and Mr. Fennel briefly reviewed the process of the transportation of grain from those districts to the seaports. There were three main routes, Hudson Bay route being developed by the government; the Great Lakes, connected with Gulf and River St. Lawrence; and the Panama Canal. To show the immense growth of the facilities for handling this traffic, Mr. Fennell mentioned that the elevators had grown from 500, with a capacity of 18,000,000 bushels, in 1900, to over 3,500, with a capacity of 200,000,000 bushels in 1917.

The speaker alluded to the competition with United States ports for this trade, and remarked that the St. Lawrence route had decided advantages over the Erie Canal route, in the way of shorter canal voyages and depth of water. Still, the United States had been able to retain a large share of the trade, owing to the use of larger vessels and by improving the railways between Buffalo and New York. He asserted that Canada had the most efficient and most economical waterway on the north American continent, and stated that 65 per cent. of the water-borne commerce of Canada came by way of Montreal.

Mr. Fennell briefly described the natural difficulties which had been overcome in building up the ports of Glasgow, Newcastle, and Manchester, at a very heavy cost, and yet, he said, Montreal did as large a trade, on a monthly basis, as these ports, at a total outlay of $27,000,000. The system in Montreal was on a pure business basis, without any political considerations, and without any of the disadvantages, from the point of view of granting monopolies to big corporations, which obtained at so many of the United States ports. The American ports were now copying many of the features of the Montreal system. Montreal was being systematically developed with a view to obtaining the supremacy in the contest in which the United States and Canadian ports were engaged for the trade of the northwest.

Brig. Gen. A. E. Labelle, one of the Harbour Commissioners, made a short speech.

Electro-culture at Chester, England

An interesting report on electroculture experiments, carried out during the past summer, has just been presented to his corporation by Mr. S. E. Britton, city electrical engineer of Chester, Eng., and is published in various British magazines. The land, comprising 1.4 acres of pasture, was plowed and trenched shortly after Easter and arranged in three plots of approximately: A, 970 square yards; B, 4,000 square yards; C, 1,800 square yards. The largest plot was equipped for electroculture, and lies between the two smaller plots.

For comparison three varieties of potatoes were planted, and the following result was obtained:

Plot A, natural control—Number of roots: Great Scot, 413; King Edward, 315; Summit, 359. Average yield per root: Great Scot, 1.363 lb.; King Edward, .485 lb.; Summit, 1.344 lb.

Plot C, natural control—Number of roots: King Edward, 238; Summit, 398. Average yield per root: King Edward, .567 lb.; Summit, 1.497 lb.

Plot B, electroculture—Number of roots: Great Scot, 2,294; King Edward, 480; Summit, 7,294. Average yield per root: Great Scot, 1.684 lb. (23.5 per cent. increase); King Edward, 1.231 lb. (153 and 117 per cent. increase); Summit, 1.451 lb. (7.5 increase; 3.1 per cent. decrease).

With regard to the Summits grown on Plot C, it should be noted that the supply wire from the shed to the discharge wire was passed over this ground, at a height of 8 ft.

Other vegetables were grown, but, owing to late planting, ttempt was made to obtain comparative result. Peas, eans, white turnips, swedes, and beet did well; carrots and onions were very poor, both in quality and quantity. Greens did well, and it was noticeable that those under electroculture were not attacked by caterpillar to the same extent as those under natural control. No manure or fertilizer was used.

The electrical equipment consisted of a 10 in. coil, with mercury break-current interrupter and Lodge valves, housed in a wooden shed, 25 yards from the plot, and an earth plate close to the plot. No. 30 s.w.g. galvanized steel wires were used for the discharge, placed 15 ft. apart and hooked to 7/16

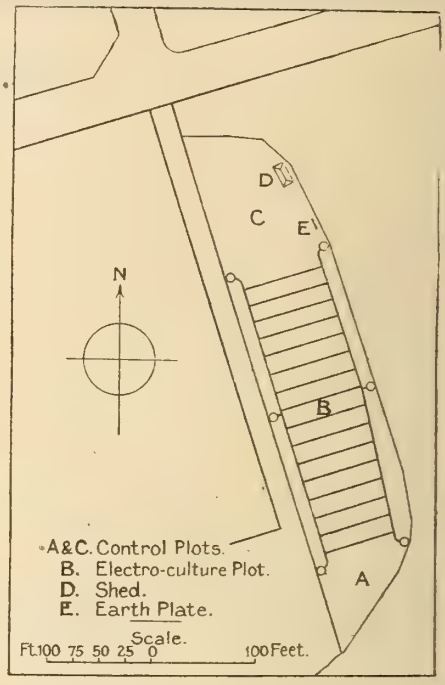


Fig. 1—Plan of Ground Used

in. s.w.g. span wire attached to insulators; and the whole supported by six poles. To each of the poles was fixed a wrought-iron bar, which enabled the discharge wire to be placed at any distance from the ground between 2 ft. 6 in and 6 ft. 6 in. The apparatus was supplied with 5 amperes at 210 volts d.c., which would maintain a spark ¾ in. long. when an earth wire was placed that distance from any part of the discharge network.

At the commencement the discharge wire was placed as near as possible to the ground, and, as the crop grew, raised

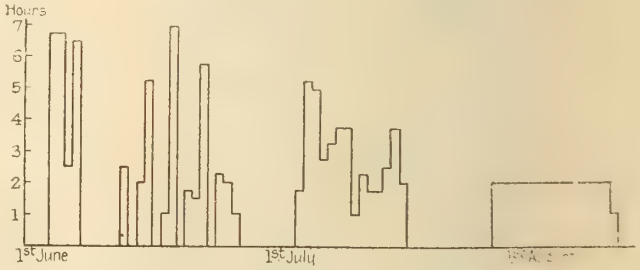


Fig. 2—Diagram showing hours per day discharge used

to about 6 in. above the foliage. When climate and other conditions allowed, the discharge was used from 6 a.m. to 8 a.m. and 6 p.m. to 8 p.m. daily, and during dull days between midday and 2 p.m. In all the discharge was used for 122 hours, during which time 128 units were used. The direction of the wind was from the south 16 per cent., southeast 23 per cent., southwest 42 per cent., and west 19 per cent.

This experiment indicates that it is not detrimental to place the discharge wire near to the plant, and that for experimental purposes and to obtain comparative results it is not necessary to have the control plot several hundred yards distant from the plot under electrical treatment, as is the case

when the discharge wire is placed 10 to 15 ft. above the crop.

Mr. Britton concludes that although the subject is a complex one, and at the present rate of progress will take years to develop, the possibilities appear to be tremendous, and when it is better understood astounding results may be expected. It should, however, be made perfectly clear that its present state of development does not warrant its general application, and that there is yet to be evolved a more settled conception of the botanical effects and electrical requirements on which to base the practical work; therefore, at the present time results should be treated as experimental. Probably the most useful progress would be made by encouraging electric supply undertakings in conjunction with plant physiologists to systematically experiment on small plots.

Develop Our Water Powers and Be Independent of Coal

But the world must be very largely rebuilt, and development must be along scientific lines, which have not been followed heretofore. That brings we down to what I really want to impress upon the gentlemen present—not that I expect to give you a speech on this subject, for I realize that I do not know nearly as much about it as you do—and to impress upon every man and woman in this country, and that is the need of building up of this and every other civilized country when this great struggle is over. There are so many things around us waiting to be done, and they can only be done on proper lines, and that means on proper engineering lines. As far back as I can remember, the idea seems to have been that when a young man went into the engineering profession about the only work for him to do was on the railway survey. You see, that is all that we realized the engineer was for. And when he got through with one job he looked for another. I presume that is the experience of many men—and I see here to-day gentlemen of my acquaintance whose heads are getting as bald as my own, who have had great experience in the railway service, and I think they realize that, especially in the rural parts of our section of the country, that has been the idea of the field of usefulness for the engineer. But when the war is over we shall find that too narrow an application of engineering skill. Of course, we must have railways. I do not want to discuss the railway situation of Canada to-day, but I may go so far as to say that we are pretty well supplied with railways—at least, the Government of Canada is. Without discussing the construction of more railway, I realize that the government railways must be reconstructed. They must be safe for the trains that run over them. And this work of rebuilding is going to call for engineering ability and service. But when we have considered the railway needs we have only commenced to discuss the real engineering problems which Canada has to face. I should say that the first problem we have to face is the development of our water-powers. I may be considered a crank on this subject, but it seems to me that the experience of this country in the past three or four months because of the lack of coal must set every man thinking, even though he be the most ordinary layman in these matters, on the necessity of developing our water-powers so as to make ourselves independent of coal as far as possible, at least for power. I do not say the same applies to heat. We were having a very interesting discussion at this table during luncheon on this point. I do not believe that we have yet reached the stage of development where we can economically heat our buildings with electricity. But if all the power we use were developed electrically we could save an enormous amount of coal, sufficient to heat all our buildings. But there are applications of heat in which electricity can be used, especially in cooking. I was surprised to have your president tell me that under the ruling prices of to-day the cost of cooking for an ordinary family is $2 a month. That is away below the cost of cooking with coal. This illustrates how water-power can be used, not only for power but for heat, and in a hundred and one things necessary in the world to-day. When I look around the city of Ottawa, which really exists on account of the development of your water-power, and realize that probably not one-quarter of the available water-power within twenty miles of the city is yet developed, I sometimes wonder what could be accomplished if we had sufficient money and energy to have all these water-powers developed. I never drive up the Gatineau without thinking of the great water-powers there that are going to waste. And up the Ottawa there is the same condition. And when you come to the St. Lawrence River you have power going to waste by the million horse-power. I am not advocating any policy—I do not think it would be wise to do so, occupying the position I do—but if I might be permitted an expression of personal preference, to me there is a great deal more beauty in water-power developed and working than in water-power going over a rapid. I quite admit that I have not been trained along the aesthetic lines on which some of my neighbors have been led, and so may not sufficiently appreciate the beauties of nature. But I do appreciate the beauty of water going through a water-wheel. And I quite understand, also, that this desire cannot be brought about except by co-ordination of the training of the engineer and the capital of the man who is willing to risk money to make more money. I am not talking questions of policy, but I hope that I shall live to see the time when there will not be one rapid on the St. Lawrence, but all will be converted into water-power and making money. And what I say of the rapids of the St. Lawrence I say with regards to every waterfall on every river in the Dominion.

* Extract of an address by Hon. F. B. Carvell, before Ottawa Branch C. S. C. E.

Hydro Expenditures

Some nine million dollars have been placed in the estimates to be expended by the Hydro-electric Power Commission of Ontario in developments and extensions. This work is to be apportioned as follows:—

Chippewa Power Development	$4,175,000
Niagara System Extensions	2,856,268
Central Ontario System Extensions	588,185
Nipissing System Extensions	60,000
Severn System Extensions	405,212
Eugenia System Extensions	233,541
Wasdell's System Extensions	1,000
Port Arthur System Extensions	150,000
St. Lawrence System Extensions	251,000
Muskoka System Extensions	6,800
Rideau System Extensions	117,945
Service Building and Miscellaneous	100,000
Expenditure on Account of Province	110,000

The Edmonton Electric Light and Power Department made a surplus for the month of January, 1918, after paying all charges, of $19,376.18. The revenue for January constitutes a record for any month in the history of the department, as did also the number of consumers connected. The Canadian Northern Railway Company's shops have installed an additional 120 kv.a. synchronous motor on city service, to be used for driving an air compressor, and the Western Canada Flour Mills have installed a 75 h.p., 2,300 volt motor at their local mill.

The Department of Trade and Commerce of Canada reports that there is a large demand for electrical equipment and accessories in Australia. A range of samples and all particulars are on file at Ottawa.

Electric Drive in a Canadian Cement Mill

A Severe Test for Motors Owing to Dust Conditions—Only Few Minutes Rest Once a Week—A 14,000 H. P. Installation

Electric motor drive in a cement mill constitutes one of the most severe forms of service, owing largely to the unavoidable prevalence of dust, and requires careful and continual inspection. The plant of the Canada Cement Company at Longue Pointe, near Montreal, operates 24 hours a day, and 7 days a week. When running to its full capacity, the motors driving the grinding mills will probably be shut down for a few minutes only once a week and for longer periods for repair to the mill probably once in six months, which means that the motors are practically running continuously for six months. In the case of elevators and conveyors, these are seldom shut down except to change motor bearings or to replace conveyor belts or screws. It is very important that these conveyors and elevators be kept running continuously, as generally a shut down of one of these means a shut down of a whole department, whereas the shut down of an individual grinding mill is not of such importance. But the service is entirely satisfactory, owing chiefly to the efficient inspection maintained by the electrical engineer, Mr. F. C. E. Burnett.

The equipment at this plant includes roughly 14,000 h.p. of Canadian General Electric motors, ranging in size from 10 h.p. at 1200 r.p.m. up to 250 h.p. at 600 r.p.m. The motors are, almost without exception, of the squirrel cage type, and are belted to their drives. The only exceptions to this rule are motors operating winches in the quarry, motors direct coupled to pumps for water supply, and the motors operating a coal handling bridge, these being d.c. motors, running on 600 volts. Power is received at 10,000 volts, three phase, and transformed to 600 volts in the sub-station. The sub-



Fig. 1—Part of installation of 16 100-h.p. motors driving pulverizers

station equipment consists of six 2000 kv.a., 60 cycle, 3 phase water cooled C. G. E. transformers. The maximum load on the sub-station has so far been about 10,000 kw. A purely induction motor load of this character would result in a low power factor, and, therefore, to supply the necessary magnetizing current to correct this there are installed two 2,000 kv.a. C. G. E. synchronous condensers operating at 600 volts. The station contains the usual equipment of lightning arresters on high and low tension sides, and high tension switches controlling the incoming lines with low tension switch gear controlling some 18 feeders on the low tension side.

In line with modern practice all drives are by individual motors, and this results in a remarkably good load factor being obtained. The load factor each month runs over 80 per cent., a condition which is hardly possible unless individual drives are employed. The motors are all controlled by N.R. compensators and all those of 35 h.p. and over are



Fig. 2—Group of 35-h.p., 600 r.p.m. motors driving kilns

equipped with over-load trip coils operating through the no-voltage release on the compensator.

While there is nothing specially worthy of note in the actual drives, the conditions under which the motors operate are well worthy of attention. A cement mill is one of the hardest of all plants on its motive power, owing to large quantities of a dust that is very hard, fine and penetrating. As will be seen from the photographs, the bearings have all special provision for keeping out the dust, but in spite of all precautions that can be taken the dust certainly does find its way into the bearings and causes heavy wear. Notwithstanding this the larger motors are often run for twelve months without having the bearings rebabitted, but the smaller motors require it more frequently. To aggravate the effect of the dust on the bearings tight belts have to be employed throughout as the dust causes a considerable amount of slipping between the belt and the pulley unless run much tighter than would be considered necessary under ordinary conditions. It is interesting to note here that most of the pulleys are cast iron pulleys, it having been found impossible to make use of the good qualities of paper pulleys owing to the dust cutting them so quickly.

Although the motors are all squirrel cage, they have, without exception, to start up against a heavy torque. In the case of tube mills and ball mills the starting torque actually exceeds the full load running torque by as much as 25 per cent. In spite of this fact no trouble has been experienced in starting up this load with the squirrel cage motor. An installation of motors working under such conditions can give satisfaction only if a rigid system of inspection is adopted. When the inspection system is faithfully carried out such an installation operates with remarkably little trouble. The Inspection Department's duties, while covering the entire electrical equipment of lighting and power,

is more particularly concerned with the air gaps of the motors. These are checked regularly by means of the gauges supplied with the motors, and a bearing is never allowed to go so far that the rotor rubs on the stator. Before the bearings reach the danger point they are changed. Another minor matter which might be of interest to those operating motors under similar conditions, is the question of dust collecting around the bearings themselves. If left undisturbed, the dust by capillary attraction soon removes the oil from the oil wells, therefore, the inspection department is charged with the duty of cleaning the bearing housings at regular intervals.

Figure 1 shows part of an installation of 100 h.p. motors at 600 r.p.m., driving pulverizers, which are used to grind the raw mixture to a fine powder before it is burned in the kilns. There are 16 of these pulverizers with 16 motors mounted in two banks of eight each. In this case it will be seen that the motors have protecting hoods mounted over them to prevent dust accumulating.

Figure 2 gives a view of one of the drives in the kiln room. There are 17 kilns in all, four of which are driven by one 100 h.p. motor from a line shaft, the others having individual 35 h.p. motors at 600 r.p.m., as shown in the photo.

Figure 3 shows the motors driving the kominuters, these being preliminary grinding machines for grinding the clinker. There are 15 such machines in this building set in one row, each having one 100 h.p. motor running at 600 r.p.m.

Figure 4 gives a view of the motor drives for the tube mills in the same building. There are 19 tube mills in this



Fig. 3—15 100-h.p. motors driving Kominuters

bank, each being driven by a 175 h.p. motor at 600 r.p.m. It will be noted in these two latter views that the motors are separately housed from the grinding machinery. This has resulted in much better operating conditions for the motors, and it will be noted that the protective shields are not found necessary in these cases.

A conference of the managers of the Eastern division, plant section, of the Bell Telephone Company, was held in Montreal on March 6.



Fig. 4—19 175-h.p. motors driving tube mills

Canadian Society of Civil Engineers Will Discuss Fuel and Power Situation

The Canadian Society of Civil Engineers are holding a general, professional meeting in the city of Toronto on March 26 and 27 to discuss the present fuel and power situation. The meetings will be held in the theatre lecture room of the Physics Building, University of Toronto. On Tuesday morning the delegates will visit the plant of Canadian Aeroplanes, Limited, and the plant of British Forgings, Limited. The remainder of the day and Wednesday wil' be taken up with addresses by such well-known authorities as Dr. B. F. Haanel, Chief of Fuel Division, Department of Mines, Ottawa; Mr. W. N. Neal, General Secretary of the Canadian Railway Association for National Defence; Mr. W. J. Dick, A.M.C.S.C.E., Mining Engineer of the Commission of Conservation, Ottawa; Mr. John Blizzard, A.M.C.S.C.E., Technical Engineer, Division of Fuels and Fuel Testing, Mines Branch, Department of Mines, Ottawa; Mr. E. Stanfield, Division of Fuels and Fuel Testing, Department of Mines, Ottawa; Mr. George F. Porter, M.C.S.C.E., Engineer of Construction, St. Lawrence Bridge Company, Montreal; Mr. C. A. Magrath, Fuel Controller of Canada; Mr. Albert Grigg, Deputy Minister, Department of Lands and Forests, Ontario, Toronto; Mr. E. J. Zavitz, Provincial Forester, Ontario; Mr. Arthur Hewitt, General Manager, Consumers' Gas Company, Toronto; Mr. F. G. Clark, M.C.S.C.E., Chief Engineer, Toronto Electric Light Company, Toronto; Mr. R. W. Caldwell, Chief Mechanical Engineer, Imperial Oil, Limited, Sarnia; Mr. J. B. Challies, M.C.S.C.E., Superintendent Dominion Water Power Branch, Department of the Interior, Ottawa; Mr. John Murphy, M.C.S.C.E., Chief Electrical Engineer, Department of Railways and Canals, Ottawa; Mr. J. M. Robertson, M.C.S.C.E., Director Southern Canada Power Company, Montreal, and Mr. P. H. Mitchell, A.M.C.S.C.E., Consulting Engineer, Toronto.

Electric Power Used to Drive Field Machinery

For House and Barn the Application of Electricity is an Accomplished Fact—Sowing and Reaping Come Next

Some practical experiments on the use of electric power in field work on the farm are described in the General Electric Review by J. H. Davidson and F. E. Boyd.. The application of electricity to the farm has become an accomplished fact around the buildings for both light and power purposes, but so far the difficulty of transmitting electric power to the more remote points on the farm has constituted an insuperable difficulty to its use in ordinary cultivation operations. The present paper describes how these obstacles were successfully overcome, and gives a number of very interesting results on the probable cost and consumption of the apparatus. The following is extracted from the paper in question:

In order to secure some definite data concerning the possibilities of electric power for field work the authors conducted an experiment which involved the following distinct features:

Design and construction of an experimental electric tractor.

Practical field test of tractor.

Tests to determine power consumption.

Analysis of results and conclusions.

The experiment was confined to the use of power obtained direct from a commercial transmission line, and storage batteries were not considered.

The tractor was designed for truck crop work. Two drivers were used with a cultivator as an integral part. It was designed to travel 140 feet per minute, and was driven by a 3 h.p., 220-volt, 3-phase motor. The machine was made by utilizing parts of other machines as far as possible. The drivers were 32 in. in diameter, with a 4 in. face. Three speed reductions were required, which were effectd by a belt, a bevel gear set, and a spur gear set. The machine carried a cable reel, and through the operation of a friction clutch the cable could be played out or wound up as desired. In operation the cable was dropped at the side of the tractor when travelling away from the main power line and picked up on the return. It was necessary to shift the cable connection at the end of the field occasionally by moving the plug connector to a new receptacle. The experimental machine, complete with 180 feet of cable and cultivating attachments, weighs 735 pounds.

Conservative estimates made in collaboration with the power company engineers indicate that the poles and line material necessary for the installation, even at the present high prices, will not exceed $110. The estimated price of the machine is $500; thus, for $610 the equipment could be put on a farm ready to operate. These figures make liberal allowances for manufacturing and merchandising, and for the electrical man on the installation.

Although it is a fact that the equipment has limits on its radius of operation as compared with a horse (which, together with harness, would cost in the average of $275), it should not be overlooked that the machine is capable of doing many things that a horse cannot do. For instance, it constitutes a portable motor which can readily and easily be moved about the farm by one person to be belted to a woodsaw, churn, pump, feed grinder, cider mill, grindstone, spraying machine, etc.

An important feature of an equipment of this character is the fact that it is capable of working continuously, where a horse can work only intermittently.

Better Success Than Anticipated

After construction the experimental tractor was given a field trial. No difficulty was experienced in handling the machine, although it was not to be expected that the first machine would be free from many impractical features. However, the machine worked better than the authors anticipated. The cable was easily managed, and the fact that the machine was tethered was not so much an inconvenience as might be expected. It was unusual to find a machine working so quietly and with so much reserve power. The tractor in hard ground, where the cultivator was set deep, would slip its drivers while the motor developed an overload of 250 per cent.

Records were made of current consumption, and the following data were secured:

Normal cultivation, current consumption, 1,867 watts.
Deep cultivation, current consumption, 2,500 watts.
Drivers slipping, current consumption, 3,200 watts.
Recultivation on soft ground, current consumption, 2,400 watts.
Cultivator on soft ground, current consumption, 2,200 watts.

A draw-bar horse-power test was made by detaching the cultivator and substituting a stone-boat for a load.

Draw bar pull, 2,285 pounds.
Time required to travel 100 feet, 46.8 seconds.
Draw bar horse-power, 0.88.
Input-electrical horse-power, 2.94.
Over all efficiency, 29.8 per cent.
Estimated output of motor, 2.48 h.p.
Efficiency of tractor, 35.5 per cent.

The efficiency of the outfit was very low. This can be attributed to the crude bearings, which were not in the best of condition.

It was noted during the tests that the slippage of the drivers while doing normal work was 2.9 per cent.; also that while reeling the cable the power consumption was less than when playing it out. This was due to the fact that the pull of the cable assisted in moving the tractor, while when unwinding there was a drag due to friction in the reel.

The following conclusions were deduced after the completion of the tests:

(a) It was demonstrated by a crude experimental machine that the soil could actually be cultivated by electric power, and that at least there were no fundamental obstacles.

(b) For garden work a light machine is desirable, keeping the power consumption low and making the machine easy to handle.

(c) The overload capacity of an electric motor is an important feature in its favor.

Comparison With the Horse

An effort has been made to compare the cost of cultivating and plowing by a horse and with this machine. It is very difficult to draw any accurate conclusions because there are so many varying and intangible factors entering into the maintenance of a horse equipment. The following approximations, although not suitable from which to draw any definite conclusions, may, nevertheless, be of some general interest:

First. Due to the greater rate at which work can be done and the continuous period over which it can be performed, it is believed that where it would take a horse about 11 hours to cultivate 8 acres (the work, of course, not being done in 11 consecutive hours), the machine could do the same acreage in possibly 8 hours (there being no question about the fact that it could be done in 8 consecutive hours). This means efficiency in the use of labor incident to operation.

Second. Although, as stated above, the cost incident to the maintenance and operation of a horse equipment is very uncertain, estimates indicate that in the cultivation of a 24-acre tract, as illustrated, there would be at least a saving of $7.50 for each cultivation in favor of electricity, plus at least a day and a half in time saved by the person operating the equipment. Opinion differs as to the number of cultivations necessary for different crops, but, of course, the more cultivations the greater the saving.

Third. It is interesting to consider what the use of this outfit will mean to the farmer with property under 40 acres, taking into account the question of how much acreage is necessary to provide pasturage and feed for horses. Any saving in this direction means a transference from the expense account to the income account.

Fourth. Expenditures for feed for the horse should not be overlooked in considering the cost of operation.

In conclusion, it is apparent from the fact that 200,000 h.p. in electric motors is now actually being used on the farm that the phrase "electricity on the farm" does not constitute an idle dream any longer. Although 160,000 h.p., of this is used for irrigation and reclamation purposes (a peculiarity to semi-arid sections), the remainder, or 40,000 h.p., is actually being used for miscellaneous farm purposes, such as were enumerated in connection with the varied uses to which the machine in question could be put on the farm. The only thing that we are not doing with electricity on any scale is plowing and cultivating, and this now bids fair to be a commercial reality in the very near future.

The Fallacy of Price-Cutting

By J. E. Bullard*

The cold weather or something else has affected my watch. Sometimes it would be fast enough so that I would have to wait several minutes before the train pulled out. At other times I would have barely time to reach the steps of the rear car before the train started. Therefore, when I heard a friend of mine say that the man up where he purchased his watch was not satisfied if there was a variation of more than ten seconds a month from absolutely correct time I decided that I would buy my next watch where he had purchased his. I was aware of the fact that the establishment from which his watch had come was rather high in price, but what was a few dollars on the purchase of an article that would last me for years, especially if the few extra dollars carried with it service that would save me many hours—in fact, enough time to more than make up any increase in the purchase price?

Last April a neighbor of mine ordered his year's supply of coal. A few months later another neighbor ordered his winter's supply, but ordered it from another dealer. The first family expected to get their coal a little cheaper than the dealer the second family ordered from would sell it. The first family has never had enough coal in the cellar to dare to build a big enough fire in the furnace to keep the whole house warm. The second family received their full order of coal within a few weeks, and have been comfortable all winter. What was a matter of 50 cents a ton compared to the worry and care of getting along from hand to mouth with the constant danger of actually suffering from the cold?

A certain church hired a certain electrical contractor to wire the building for a new lighting system. This contractor was hired because he would do the work for a low price. When the installation was completed the appearance of the church was greatly improved. There were special lights over the baptistry, for this was a Baptist church, the purpose of which was to light up this pool of water, make it safer, and make it easier for the minister to read the service. Incidentally, it also made it much easier for the congregation to see what was taking place, and, on the whole, made the baptismal services much more impressive. The first time the lights were used they worked perfectly. The next time they failed, and it was some time before the defect in the wiring that caused the failure could be discovered. These lights for several services were entirely out of commission, and the few dollars saved in the original installation were paid for at a very high rate.

It is not low prices that most people want. What they really want is the most for their money. Everybody wants service. Everyone wants real service, and every person whom it is really worth while to have as a regular customer is willing to pay for service. That concern that builds up the greatest reputation for good work and good service is going to get the most business and make the most profit. It is only the unprofitable business, as a rule, that goes to the price-cutter.

There was a time when the department stores appeared to thrive on price-cutting. Times, however, have changed. Many of the price-cutters have already gone out of the business. Others are changing their ways. Department stores are coming more and more to use something besides low prices to attract custom. Some have gone so far as never to feature comparative prices in their advertising. They do not attempt to show the public that they are selling at low prices. They rather attempt to show that they are giving good values in goods and in service for the prices charged.

A young man started a flooring business. His partner believed that they should meet their competitors on price. He, on the other hand, held fast to the idea that they should build a reputation for laying the very best floors that could be laid, and see to it that all their work lived up to this reputation. In order that he would not be handicapped in this policy he bought out his partner and ran the business himself. To-day he has the best business in his line in the city where he is located. He is busy when some of his competitors are idle, and he secures a goodly percentage of the really profitable business in his district. That is not all, however. He has been called upon to do work several hundreds of miles away from his place of business. He has been paid a bonus to supervise work near larger cities than that in which his business is located. It is the service that he renders that has brought this business to him. He has often made this statement: "If I relied upon price alone to get business I would not be able to drive my own automobile. I don't get any work on price alone. In fact, I never take the trouble to bid on any work where I know that the price is going to be the deciding factor. Most of my business comes to me from people who want really good work and are willing to pay for really good work."

Price-cutting never built good-will. There are a lot of price-cutters who are to-day bemoaning the fact that they have always secured their business by cutting prices. To-day it is not easy to cut prices. The cost of everything is increasing in price so rapidly that no business man can tell you to-day just what it is going to cost to do a certain piece of work to-morrow. Those men who have built up their buusiness through service have also built good-will, which is proving its worth to them in these days. The price-cutter of yesterday is, in fact, more than likely to be the profiteer of to-day. He is rarely, if ever, a far-sighted man. If he were he would never be either a price-cutter or a profiteer.

The church did not save very much money on its wiring job, but it lost a good deal when the lights refused to burn. It is not by any means beyond the bounds of possibility that the difference between what the collections actually were at the services when the baptismal lights did not work and what

*In National Electrical Contractor



A typical show and sales room of the Southern Canada Power Company—This one is in St. Hyacinthe

they would have been had the lights been in operating condition would have more than have paid the difference between a good job and a cut-price job. In other words, from a purely financial point of view, there is reason to believe that this church lost by having a cheap job done.

Was Getting Better Value

It may interest the reader to know that the main reason why the merchant who had his electric current bill boosted from $5 to $13 per month was so enthusiastic over this increase in cost was due to a very great extent to the fact that in the first instance he was getting only about $2 worth of service for his money, while in the second the service was saving him practically the full amount of the bill. He discovered that what he saved through increased production and in labor turnover when he used electric drive for his sewing machines amounted to as much as or more than every month the total cost of all the electricity he consumed for power purposes. Naturally, he was pleased and appreciated the service which the salesman had rendered him.

It is never very difficult to show a man of average intelligence that good service and good workmanship is worth more than a low price. Usually the difficulty lies in persuading him that you are able to give him the service and workmanship. Of course, there are some people who will always be influenced by price alone. Usually, however, these people have a very poor opinion of their own judgment. Often they do not have an average amount of intelligence. These people it is best for the ambitious contractor and dealer to leave to the mercies of his competitors who believe that the alpha and omega of salesmanship is beating everyone else on price. If this is done it will be only a matter of time until they destroy each other and business as a whole will be better for their elimination. Feature good workmanship, good material, and good service and you are bound to succeed in the end. Feature cut prices and the sheriff will get you if you don't watch out.

The death is reported of Lieut. C. R. Hillis, of Hamilton, who was wounded recently in France. Before enlisting in 1915, Lieut. Hillis was connected with the Canadian Westinghouse Company, Hamilton, as mechanical and electrical engineer. He was a graduate of Toronto University.

Code of Lighting School Buildings

The Illuminating Engineering Society of New York announces that the revised edition of its Code of Lighting School Buildings is now being placed in type. It will be remembered that the first edition of this code was circulated several months ago for the purpose of obtaining discussions and criticisms. As a result, some one hundred communications have been received from lighting experts, architects, educators, and school superintendents. These have been carefully considered by the Committee on Lighting Legislation in its revision of the technical data and principles of school lighting, which are embodied in the code.

Some 20,000,000 school children in the United States daily perform work trying to the eyes. Proper illumination is essential. Available statistics show that nearly 10 per cent of the school children who have been examined have defective vision. The exactment of rules and regulations and the dissemination of knowledge relating to correct lighting conditions is one of the most important needs of our educational institutions and legislative bodies.

While the code is intended primarily as an aid in formulating legislation relating to the lighting of school buildings, it is also intended for school authorities as a guide in individual efforts to improve lighting conditions.

The revised edition of the Code of Lighting School Buildings is being printed, and the society will be glad to sell them at cost to interested parties.

Companies Object to Using Same Poles

The question of the regulation of poles and wires of public utility companies in Montreal recently came before the Quebec Legislature. The city asked that the subject be referred to the Electrical Commission for study and the drawing up of regulations, the latter to be submitted to the Quebec Public Utilities Commission for approval and then, in turn, submitted to the legislature at the next session. It was suggested that two or three companies might use the same poles. The companies objected to the form of procedure, which also did not meet with the sanction of the legislative committee. The result of discussion on three days was that no final decision was reached.

Availability of Energy for Heat and Power

By John Blizzard, B. Sc.*

It is proposed here to outline the sources whence we in Canada receive our supplies of energy and the requirements they meet.

Coal

Coal is of first importance. In the course of a year we burn 30,000,000 tons, of which 60 per cent. comes from the United States. The remainder is mined in Canada.

Practically no coal supplies exist between the Provinces of New Brunswick and Saskatchewan, and the combined output of these two provinces amounts to only 4 per cent. of the country's production. One-half of the remaining 96 per cent. is mined in Nova Scotia and the other half is mined in the Provinces of Alberta and British Columbia. The coal reserves of Canada are enormous, and we may rely on a continuance of native supply for a very long period of years. Whether we may place equal reliance on our supply from the United States or not is uncertain. The present shortage seems to be due to abnormal difficulties of transportation rather than those of production. It is certain, however, that the supply of anthracite from that country will decrease, and that the time is not far distant when they will come to us for their supply of coke or coking coals.

A part of the annual coal consumption is accounted for as follows:

	Tons.
Manufacture of coke	2,000,000
Railway locomotives	9,000,000
Collieries	1,000,000
Bunkering ships	1,000,000

The remaining 17,000,000 tons are used for domestic and general manufacturing purposes. An approximate estimate of its subdivision is: Five million tons for domestic heating, six million for industrial heating, and six million for industrial power.

Assuming that the colliery consumption is for power purposes only. and that 7 pounds of coal generates a horse-power hour, the total mean continuous applied horse-power in Canada derived from coal is 500,000, of which locomotives develop 300,000.

Water-Power

Water-power is used for the most part to supply mechanical and electrical energy. About 2,000,000 horse-power has, so far, been developed The total available horse-power is estimated at about 18,000.000, of which 8,000,000 is estimated to be available within the present range of markets. An additional development of 6,000,000 horse-power, assuming an efficiency of conversion of 60 per cent. and a plant factor of 40 per cent. would supply about 1,500,000 horse-power continuously. This is much more than sufficient to supply that generated yearly by our 16,000,000 tons of coal.

Wood

Wood is a very important Canadian fuel. The estimated value of firewood used during 1916 was $62,000,000, or more than the value of our coal imports. Although to some extent, its use may be for power generation, principally in log-product factories, it is probable that most of it is used for domestic purposes. It is not likely that it will, to any extent, be able to take the place of other forms of energy, except spasmodically, as in times of an acute scarcity; nor is it likely that other forms of energy will take its place.

Oil and natural gas occupy an inconspicuous position compared with wood, coal, and water-power. The annual oil consumption is about 250,000,000 gallons, and practically all of it is imported. It is in a more available form for the generation of power and heat than any other fuel. While not impossible to replace it with other forms of energy for small gasoline and kerosene engines, such a change could be effected only with great inconvenience. In addition to its use for these purposes, crude oil in large quantities is used, particularly in the West, for railways, ships, and industries. Altogether, at least 100,000,000 gallons are burned under steam boilers.

Mr. Van H. Manning, director of the United States Bureau of Mines, in reviewing the oil situation of that country, estimates that its supply at the present rate of usage will last only 25 years. He further remarks that petroleum should be used neither for gas manufacture nor for fuel under boilers, nor in any way to compete with coal. It would appear, then, that we must soon find another source of supply. This may come from the known shale deposits of Canada or the United States or, possibly, from the vast unexplored areas in the west of Canada. The distillation of oil shales would not be a new venture, since, in Scotland, 3,000,000 tons are produced annually, giving about 20 gallons of oil to the ton. Another source f oil is tar obtained from the distillation of coal and lignite. Benzol, another coal-distillation product. is an excellent motor spirit, though to counteract its tendency to freeze at only fairly low temperatures it is necessary to mix it with alcohol or gasoline. Still another coal by-product, napthalene, may be used for explosion motors.

There is no doubt that alcohol is destined eventually to become prominent as a motor spirit. It is of particular importance, since it may be obtained from vegetation, and is thus independent of the stored sources of energy.

Natural gas is used in particular districts adjacent to the gas fields. Its high caloric value—nearly twice that of coal gas—renders its distribution over a large area economically possible. The annual consumption in Canada is about twenty million thousand cubic feet. It is used for industrial and domestic purposes. Since it is in a form more available for the generation of power than any solid fuel, it is advantageous to use it for this purpose whenever possible instead of coal.

Peat

Peat contributes practically nothing to our energy requirement. Yet it exists in large quantities throughout the Dominion; and, in view of its success as a fuel in other countries and the information obtained from its manufacture and use here, its availability for the generation of power and heat is known. It is impossible to believe that there is no field for its exploitation, and it must be expected soon to find a position as a source of heat and power.

This faint outline of our requirements and sources of energy does not afford information sufficient for proceeding with an enquiry which will lead to the connection of the user of power and heat with the most available form of energy. Here the possibilities of increasing the availability of our supplies of energy will be considered with reference to special methods. They will refer only to the establishment of central stations for the use of the solid fuels and to the possibility of using hydro-electric energy for house heating.

Central Station Supply

The central station may be designed to supply electrical energy, gas, steam, liquid fuel, solid fuel. and various by-products, many of which have no connection with the generation

*Extracts from paper before Ottawa Branch, C.S.C.E.

Economy. The economy of operation depends upon many factors one of the most important of which is a large system in which there is more complete utilization of the full capacity of the plant. This is due to non-coincidence of the maximum loads of the various consumers, better thermal efficiency of conversion due to the use of larger units, more complete and intelligent supervision and design, and to the possibility of operating for longer periods at the more economical rated load. The limit of the central station's sphere is reached when it is cheaper to haul the fuel to the consumer than to deliver energy through pipes or along a wire. It varies with local conditions and the type and price of the fuel. It will be greater for low-grade than high-grade raw fuel since costs of transportation vary with quantity and are independent of energy content.

The largest field for the central station will be in the generation and distribution of electrical energy. The rough estimate of the mean present power load now met by coal showed the very large requirement of locomotives. To replace the uneconomical steam locomotive with the electric locomotive seems at first sight a rational project. Where the substitution has taken place the coal consumption in the central steam electric stations is one-half of the former consumption on the locomotive. There could be no objection to its substitution for oil in forest areas and the present damage from locomotive soot and sparks would cease. An examination of the roads electrified shows that they are confined for the most part to suburban and mountain traffic. But the electrically equipped mileage is increasing, and the continuous increase in the price of coal brings the day of general electrification nearer.

The remaining power, which is used for general industrial purposes, is in itself of magnitude sufficient to warrant the consideration of central station supply. Whenever external electric supply takes the place of energy generated at the plant itself economy results. In many districts this change has resulted in reducing the coal consumption to one-quarter of its previous magnitude.

Central stations distributing gas have not so promising a field as those distributing electrical energy. The costs of transmission and the relatively high efficiency of conversion of coal into heat energy in the plant itself reduces the possible gain to the buyer. Nor is it likely that the substitution of this type of plant would save fuel. Nevertheless, the cleanliness and improved availability of gas as compared with coal would frequently lead to its preference by consumers.

Types of Central Stations

They may be of the following four types:

a. Those in which the fuel is completely gasified by partial combustion and the energy distributed either as gas or electrical power.

b. Those in which the fuel is carbonized and energy distributed in the form of solid fuel, and gas or electricity.

c. Those in which the fuel is completely burned and electrical energy and steam distributed.

d. Those in which fuel is completely burned and electrical energy only distributed.

A consideration of these stations follows:

a. The by-product recovery producer plant is the most promising means of totally converting solid fuel into gas. Its economic importance lies largely in the high returns possible by the recovery of from 60 to 70 per cent. of the nitrogen in the fuel in the form of sulphate of ammonia. It is of great value for the exploitation of low-grade fuels, particularly peat, whose nitrogen content is high compared with its calorific value. The gas produced has a heat content of about one-fourth that of coal gas. It may be distributed to consumers or partially converted into electrical energy by use of gas engines or boilers and steam turbines.

In South Staffordshire a plant has been in operation for some years, and supplies gas over an area of 123 square miles. The price paid for the gas varies from 3 to 5½ cents per thousand cubic feet. The fuel used is slack coal of a fairly low calorific value. This is the only plant which distributes producer gas on a large scale, and it is noteworthy as a possible reason for its unique position that no dividends have been paid for some years.

In Italy two by-product plants, using peat, are in operation. The energy is distributed electrically.

b. The two outstanding objects of carbonizing coal are to obtain a maximum yield of either coke suitable for metallurgical purposes or of gas suitable for domestic purposes.

The first method of carbonizing is carried out in coke ovens, wherein the long time of carbonization, large size of charge and compression give a coke of the requisite great density and hardness. It is possible with modern coke ovens to obtain a yield of gas more than sufficient for heating the charge, about 20 per cent. of the nitrogen in the coal as ammonia, in addition to light oils and tar. The surplus gas is usually of only slightly lower calorific value than town gas, and is eminently suited for distribution for general use, or may be used as a fuel at the plant for the generation of electrical energy.

The second method of carbonization differs from the first, in that smaller charges are used in order to obtain the necessary quality and quantity of gas, none of which is used for heating the retorts. As with coke ovens, coke, ammonia, benzol, and tar are recovered as by-products from retorting coal. The yield of coke, however, is less, and some of it is used for heating the retorts, while the ammonia yield is greater, due to the smaller contact with the smaller charge.

The coke obtained from retorting the gas is soft and loose in structure, and may be used in domestic furnaces. Its disadvantages for this purpose are its bulk—which necessitates more frequent firing than with coal and larger storage space—and its tendency to clinker.

The choice of installing coke ovens or gas-making retorts, both of which require much the same class of coal, obviously depends upon the possible market for the products. The development of a domestic fuel trade in the soft coke is possible if a suitable market can be found for the gas. Metallurgical coke, on the other hand, is not so suitable for domestic purposes, since it is very hard, difficult to ignite, and requires a strong draft to burn it. Nevertheless, it may prove a valuable and economical substitute for anthracite coal, if sold at a reasonable price.

c. The third type of station represents the most economical means of generating power where coal is reasonably cheap and all the exhaust steam may be used for heating. The prime mover may be either a steam engine or steam turbine of a comparatively cheap type, and no condenser is required, since the power may be looked upon as the by-product and the steam as the most valuable product. It is not possible frequently, however, to find useful employment within a small area for the exhaust steam, and heat losses prevent the transmission of thermal energy in the form of steam or hot water over a large area. On the other hand, it may prove feasible to generate power in plants where a heating load exists and transmit electrical energy to customers in the neighborhood.

d. This is the most popular type of power plant and in large sizes consists of boilers, turbo-generators, and condensers. It is too well known to need description, but it is interesting to note that steam turbines are made of 70,000 kilowatt capacity, and operate with steam pressures and temperatures as high as 350 pounds per square inch and 690 degrees F.

Electric Railways

Street Railway Passenger-Fare Charts

By C. A. Cornwall

In all cities and districts served by a street railway system, there is a relation connecting the number of passengers carried per day and the fare charged. This relation is somewhat difficult to determine as there are at least three important factors which have to be considered, the first and most difficult factor being that which might be called the "human factor," that is, a factor covering the inconsistency of human nature. Second is a factor which might be called the "prosperity factor"; this factor would be dependent upon the prosperous condition or otherwise, of the place in question. The third factor is the "relation"; that is, the feeling, either good or bad, existing between the railway company and the general public.

These three factors may, within certain limits, be obtained in a combined form if the railway company has tried several different fares at various times, and kept a record of the variation in the number of passengers carried, corresponding to changes in the fare charged.

In a certain city with a population of approximately forty thousand there has been in the last three years, three changes in fares, and the corresponding numbers of passengers carried per day are shown in the "Fare-Passengers Carried" chart. During the three-year period covered by these fare changes the "prosperity" and "relation" factors would be practically unchanged, thus leaving only the "human" factor to determine.

It will be noticed that a line drawn through the three determined points representing the number of passengers carried per day at the different fares, passes through the forty thousand mark on the passenger carried scale when the fare charged has been reduced to zero. This result appears to be quite consistent as this number of passengers carried is the approximate population of the district served. On producing this line in the opposite direction it is seen that it cuts zero point of passengers carried when the fare charged reaches twelve and one-half cents. This also appears reasonable when it is considered that there are eleven routes of varying length in the system operated.

Referring again to the "Fare-passengers carried" chart it will be seen that:

$$\tan \phi = \frac{40{,}000 - N}{2{,}000\,F} \quad \text{or} \quad F = \frac{40{,}000 - N}{2{,}000 \tan \phi}$$

When:

N = Number of passengers carried per day.

F = Fare charged in cents.

ϕ = Angle which the "Fare-Passenger" line makes with the "Fare" line.

The factor 2,000 represents the relation between the passenger and fare scales.

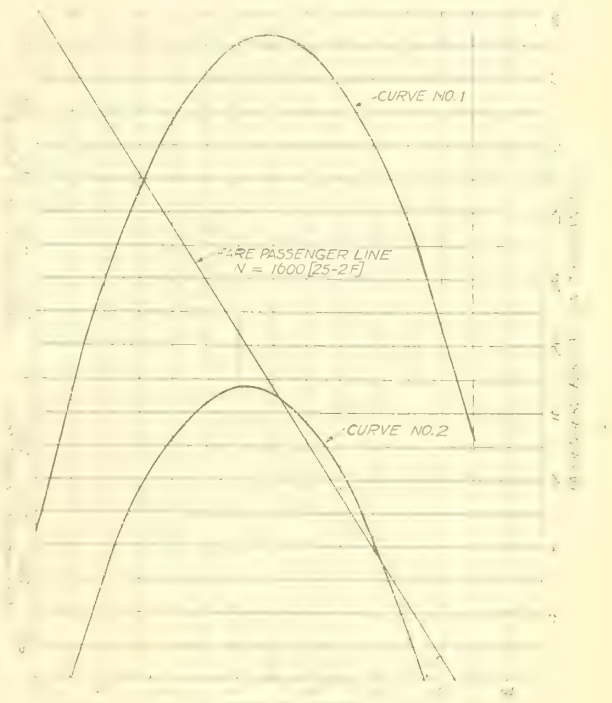
In the case in question the angle ϕ is 58°, making:

$$F = \frac{40{,}000 - N}{3{,}200}$$

Having now obtained a value for N in terms of F it remains to determine the profit (positive or negative) per day for various values of F.

Let:

P = Profit per day in cents.



Fare-Passengers Carried Chart

E = Earnings per day in cents = NF = 1600 (25—2F)F.

C = Total operating cost per car per day.

N = Total number passengers per day = 1600 (25 — 2F).

$$X = \text{Number of cars running per day} = \frac{N}{AT} = \frac{1600(25 - 2F)}{AT}$$

A = Carrying capacity for each car.

F = Fare charged in cents.

T = Average number of half trips each car makes per day.

Now Profits = Earnings — Costs.

Or $P = E - CX$.

$$= 1600\,(25 - 2F)F - C\,\frac{1600\,(25 - 2F)}{AT}$$

Differentiating for P maximum gives:

$$F = 6.25\,\frac{C}{AT}$$

In the above equation it is assumed that the passengers are equally distributed at the opposite ends of a line and re-

the railway company. It also presumes that each car is filled to its capacity. These would be ideal conditions from the railway company's point of view, but are not to be found in practice.

Curve No. 1 is plotted from this general equation. The value of C/AT being taken as 1.15, P becomes a maximum when F = 6.82 cents and zero when F is either zero or twelve and one-half cents.

In practice it is generally necessary to run cars according to a certain schedule, and this schedule determines the number of cars used. When this is the case the cost expression in the equation becomes a constant. If this constant be taken as 127,000, we get the curve marked 2, which shows the system is operated at a loss for all values of F, the minimum loss being when F = 6.25 cents.

The writer would point out that great care would have to be exercised in making out and using these curves, but considers that in the case under consideration they are approximately correct between fare values of 3 and 7 cents.

Winnipeg Citizens' League Condemns the Jitneys

The matter of jitneys vs. electric railway service has been taken up in Winnipeg by the Citizens' Research League. Conditions in Winnipeg are such that the railway company, formerly a most prosperous organization, now finds it difficult to do much better than meet base operating expenses. As a natural result they will be unable to maintain the standard of service to which Winnipeg citizens have been accustomed and the Research League, realizing the facts, urges the suppression of the jitneys. Their recommendations in this respect were set forth as follows:

1. Service is limited, the jitneys plying only in the central, crowded, and therefore profitable parts of the city, but neglecting the suburbs and outlying residential districts. Moreover, there is no cross-town service and the service on Sundays and at nights is irregular, even on routes usually covered.

2. There is no routing of cars by the city.

3. No time schedule is observed.

4. The jitneys are not required, as is the Street Railway Company:

(a) To give free transfers, cheap tickets for workmen and children, free transportation for members of the police and fire departments of the city when in uniform, policemen and detectives wearing a badge, and postal letter carriers;

(b) To contribute towards the upkeep of the city pavements;

(c) To hand over a definite percentage of their earnings to the municipality.

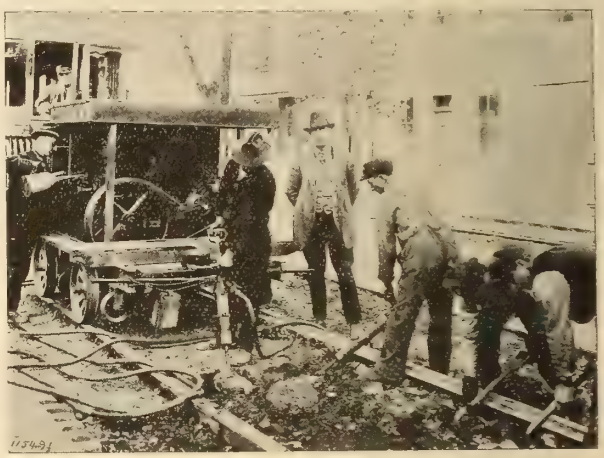
5. There is no financial responsibility for damage done, aside from a bond of $200 for property damage, $1,000 for personal injuries to an individual, with a maximum of $5,000 for any one accident.

It may be added that under present conditions the jitney involves wasteful employment of labor which could be much more effectively used elsewhere. The jitney hampers the financing of the Street Railway Company and prevents the raising of capital for additional lines or improvement of the service. In Professor Shortt's words, "instead of the electric street car being sacrificed for the preservation and extension of the jitney, the jitney should be sacrificed for the preservation of an electric service in the best interests of the public."

Apart altogether from the question of the rights of the Street Railway Company to an exclusive franchise for street transportation, the League holds that, unless the group of jitney owners can so organize themselves as to be held to a satisfactory agreement regarding the operation of their cars under terms corresponding to those governing the street railway, it is desirable to prohibit their general operation.

A Portable Compressor for Electric Railway

It has been said—and probably with entire truth—that there is not a sufficient number of men on any construction work in progress to-day. Hence, machines that can save a considerable amount of labor have become more imporant than ever in our industrial life. A machine of this kind, designed specially for the use of electric railways, is a motor-



driven compressor, mounted on a standard gauge truck and operated from the trolley circuit. The range of usefulness of this machine for track and road work is very wide, since it will operate tie tampers, track drills, chipping hammers for toothing out bricks, air blasts for cleaning rust from structural steel work, and many other pneumatic tools. The outfit consists of an 8 x 6 inch Ingersoll-Rand compressor, driven by a 15 h.p. 550 volt Westinghouse direct current motor, with starting rheostat, knife switch, and fuses. It is hauled to the job by a trolley car, and when connection is made to the trolley wire it is ready for use. Two tie tampers, chipping hammers, or other instruments can be used at the same time. Four small wheels, mounted at right angles to the main wheels, permit the outfit to be run off the tracks on heavy timbers. In a test made under continuous traffic conditions



it was found that the cost of tie tamping with this machine was one-half that of hand tamping, and better results were obtained, as no second tamping was necessary, due to settlements under traffic. Further, it was found that two men with the pneumatic tampers could do the work of ten laborers. Equally satisfactory and rapid results were obtained in tearing up concrete, clearing rust from bridge rollers and seats, drilling bolt and tie rod holes, pocketing and cleaning bricks.

The Dealer and Contractor

Remedy for the Ills of the Electric Merchandising Industry from a Contractor-Dealer's Standpoint—More Co-operation and a Closer Acquaintance Among the Members of the Trade*

We are all united in feeling that there are great chances for improvement in the electrical merchandising game. We, as contractors, are finding that we cannot solve these problems alone—we have invited you in to help solve these ever-changing problems. We are anxious to be shown. We come to you.

We ask you to show us what we can do to improve conditions among ourselves and in our relations to customers, jobbers, or central stations.

This isn't our fight any more than it is yours. We shouldn't be begging you to join this association. Our money and time is just as dear to us as yours is to you.

We have suffered from lack of co-operation, but we have profited from the sacrifice and good work of others. What do we propose to do? What do you propose to do? You say you will wait; you're not going to be the goat This is the fairest plan of assessment of which I know—to pay in proportion to the business you do. If you can't afford to do this, you better do less business and make more profits.

Merchandising

We must become merchants, carry a representative stock of appliances, and be prepared to put out new appliances on trial. Putting out sample lighting installation, installing heating devices, vacuum cleaners and washing machines are the up-to-date ways of merchandising. If we don't do this, the hardware or jewelry store will beat us to it. The hardware store will carry some of these appliances, but they are handicapped in not having practical electrical men to advise and repair. The mail order house may undersell you, but if you are in a position to demonstrate, try-out, and repair and exchange for different sizes you will get the business.

No Kicks Afterwards

We need men of vision who can suggest what will be needed on these jobs in years to come. Do you know that we have lost several jobs which we would probably have done by suggesting some of these extra openings The architect takes offence at these suggestions. The owner may think you a grafter. He will not after the job is done. I never yet had a customer kick on too many switches or openings after the job is completed. Get the job first, make your suggestions after. Most complaints are as to place, never because there are too many openings. Sometimes there are complaints of not enough openings.

Ills of the Industry

It is my intention to touch upon a few of the ills of the industry from the contractor's standpoint in his relation to his fellow-contractors, the lighting company, the jobber, manufacturers, and incidentally the electrical engineer and architect.

One of the most serious problems the contractor-dealer has is in relation to his fellow-contractors and dealers. He wants the business. He will have to lay off his men and even go out of business if he does not get work. A job is to be figured on. He has no intention of taking this job at a low figure, at cost, or even less, but as he begins to figure this he will incidentally think of the other contractor, and, instead of adding the amount for incidentals, the amount for overhead, and the amount for profit, all of which are rightfully his, he cuts off here and omits there. The result is he submits a figure which is away below what it should be. If he gets the job he is obliged to work practically for nothing, and his whole mind is centered on cheapening the job. He does not enjoy doing work under these conditions, and his feeling towards the other fellow leads him to dislike the other fellow as well as his own work. If the other fellow gets the job he may rejoice to think he was a lucky man, when, in reality, he would have done better if he had let it alone. Get a good price for your work.

Be a good loser. Many of us have shown our lack of generalship and our lack of business tactics by being sore because we didn't do the work by saying we had better stuff figured on, while, in reality, why not say: "I think you are going to get a good job; he does good work. Sorry we lost the job this time, but hope we can do business with you some other time."

Begin "At Home"

Our first remedy, therefore, is to begin at home, to so organize and pull together that no one man will feel that he is entitled to the cream. This means meeting on a common level at frequent intervals, both large and small contractors, looking the other fellow square in the face, admitting the wrongs and mistakes, and with a whole-heartedness agree to start in again with a clean slate, forgiving and forgetting. If you can't forget, forgive.

After all, our biggest enemies are often ourselves. Our imagination causes us to distrust and eventually to despise the other fellow. The habit of meeting frequently, of even calling our competitor over the phone, will head off much of the mistrust and misunderstandings that are so liable to exist.

The Central Stations

It has come to our notice from several parts of the state that there is a lack of harmony between lighting companies and contractors. This condition is unfortunate. A new factory is to be started; motors are needed. The lighting company is consulted as to the kind of current available. No sooner has the contractor asked for this information than a solicitor from the lighting company is there trying to sell motors, and even talking of installing them with the suggested argument that they are doing or can afford to do work cheaper than the contractor. Under conditions of this kind you can readily understand how anxious the contractor is to consult

* By W. R. Johnson before Wisconsin Dealers' and Contractors' Association.

company when the next job is in sight. How contractors are the best asset the lighting companies have. Contractors are the unpaid solicitors of the Central Station. We wouldn't be in business if it wasn't for the lighting company. The lighting company should be constantly in touch with every contemplated move affecting their load, and should do only those things which will encourage and stimulate confidence and trust between the central station and contractor. The contractor should try to please the lighting company and the lighting company should give the contractor all reasonable help, and I am glad to say in many localities this condition of co-operation exists. It results in better installations. When Jones is dissatisfied with his light bill and comes to the contractor, the contractor does all in his power to straighten out the trouble. If the contractor has done some work and the bill runs a little higher than the customer expected, he consults the central station, and how easy it is for the central station to assure him that the bill is correct, that the contractor always does good work—which generally settles the matter. We believe that as a result of the getting together of the local electrical interests as outlined in the Goodwin plan, these differences and misunderstandings between contractors and central stations will largely be done away with.

Now for the "Jobber"

The biggest contention against the jobber is that he will sell the consumer isolated plant, or factory at the same price or often for less money than we can buy it for. If we order a bill of lumber we have to pay the regular retail price for it, and if some carpenter contractor is called in to do the work he is entitled to his courtesy discount on that bill of lumber. This we believe is true in almost any other line of business. We see no objection against the jobber selling direct as long as the price is maintained. We are glad to say, however, that we have noted an improvement in this condidtion, and we believe this association will soon be in a position to show up any concerns who will not conform to the Goodwin sales plan and show them up so forcibly that they will be mighty glad to co-operate. If it is a question of credit and the dealer is entitled to a profit, goods may be shipped direct to the consumer and the dealer could be allowed his profit just the same. Further, if there seems to be no one to ship the goods through, the retail prices should be maintained.

A factory wants a signal horn system. They write to the jobber and to the manufacturer for prices, and they ask the local contractor what he can furnish these horns for. All these prices should be the same, and the suggestion should be given from the manufacturer that these goods may be purchased through the local jobber or the local contractor at the same price. As far as our experience goes, there is less complaint against the manufacturer, except possibly in the line of electric appliances, and yet we have every reason to believe that the manufacturer is going to stand with us absolutely on the Wheatstone Bridge sales policy.

The Architect and Engineer

There is a chance for improvement in the relation of the contractor to the architect or electrical engineer. The plans and specifications are not always clear or complete, and yet the writer never saw a set of plans which do not fortify the architect and owner and make reservations that are unfair to the contractor if the architect sees fit to enforce them. But we believe this new association is going to be so united and so broad in its scope that the architects will be glad to follow the "pull together" policy.

The Calf Analogy

The calf analogy is not quite true to the facts. It is only allegorical. There are big calves and little calves and some bully calves. If the bully is here with a pious look seeking whom he may devour, he should see the error of his ways before it is too late. If he is not here, it is the duty of this association, through its directors and field secretary, to show him up. When the calves woke up they were tired, hungry, their necks were sore, and I can imagine them saying as they got together: "We have done lots of work, but what have we accomplished We have spilled the beans. We have kicked over and wasted each other's profits. We have knocked each other's work and goods. We have looked with envy and hated each other. I'll scratch your back and you lick my ear. Let's go fifty-fifty on this one and when that one is ready we'll not scrap about it.

All Stand Together

In conclusion, I want to suggest that these are trying times, and that one of the biggest problems before this association to-day, whether it be manufacturer, jobber, central station, or contractor, will be not only to pull together, but to continue our business with as few interruptions as possible. With the scarcity of labor and material and the transportation facilities so badly blocked; with the fuel situation staring us in the face, it behooves us to stand together, borrow and lend both men and materials, practice economy, thrift, and efficiency more than ever. Good wages to the right workman and a good price for the job must result in an honest job with the best materials of sufficient capacity which will bring satisfaction to all concerned.

Jim Hare's Big Idea—The Story of an Electrical Dealer Who Seized an Opportunity*

There was really nothing wrong with Jim Hare, to begin with. He was just a normally ambitious chap, mechanically inclined and well known as the popular fix-it-up man of his neighborhood. Jim could work wonders with a screwdriver and a pair of pliers, which may or may not account for his drifting into the electrical business.

First it was bell hanging, then electric gas lighting, and finally the modern "Dirtless Workman" role of wiring residences. Jim's natural pride in his work, coupled with his ambition to lead in his line, kept him in the select class of electrical contractors who could be counted upon to wire an old house without marring the hardwood or tearing out the plaster. Jim was an artist in his business—and as jealous of his reputation as any artist that ever painted a picture.

Jim prospered. One job led to another, and before long Jim was renting a building with a store front. For a while this store front struck him as rather useless in his business, but then Mrs. Jim took a hand in things and the window became a bit of display advertising. She made a neat display of batteries, bells, wire, tape and tubes; had a sign made calling attention to the work that Jim did; had him mount an electric bell so that the hammer of the bell beat a tattoo on the window pane—and presto! Jim became an advertiser.

Naturally, as clever a workman as Jim was looked up to, the people he worked for asked his advice on everything electrical—and usually followed the course he suggested. Mrs. Customer asked him what he considered the best vaccum cleaner, or what was the best weight electric iron to buy, or how much good was an electric washing machine—and so the questions and answers ran on until Jim's fertile brain picked out the next good idea.

Jim became a regular merchant. He and Mrs. Jim talked things over and evolved a plan something like this: Instead of just handing out advice on the subject of electrical appliances, he would secure a line of them for his own shop, and then when the question came up he could answer it in such a way as to do him most good. Further than that, he would open up the subject by suggesting the various ap-

* By Tom Wright, in Contact.

pliances and Mrs. Jim would back it up by acting as demonstrator and actually making the sale in the customer's residence.

Studied His Prospects

Jim was now as keen a business man as you would want to find. The helpful literature that he got from the various houses he dealt with taught him many things about the art of selling and advertising. His trade magazines kept him in touch with the doings of his trade and many valuable ideas came to him in this manner. Jim had learned to study his prospects as closely as any good salesman should—and many a sale developed months after Jim's wiring had been finished, because of his keen analysis.

It was no longer a case of wiring a house for lighting. Jim felt it a blemish on his reputation to let that sort of a job go through. He went at it from the housewife's side of the question. He showed her the hours of hard work saved by a vacuum cleaner, the money saved by buying a washing machine; the convenience of a toaster and percolator, and there was always an electric iron to be sold—that was easier to sell than any of the others.

Jim took these things into consideration when he was laying out a job, too. He pointed out the need of a baseboard receptacle in the hall so that the vacuum cleaner could be used conveniently; he talked up the extra washing machine connection in the laundry and the special dining room socket that would be convenient to the table so that appliances could be used there. Jim played his game thoroughly. He did not get drawn into a conversation on the prices of these various appliances. He concentrated on first getting the extra sockets installed. He told stories of past jobs, how the people had thanked him over and over again for his assistance upon the extra sockets, how others had opposed him and told him later of their regrets. Jim had a good argument, backed up with stories right out of his day's work—and usually he had his way. Then started the workings of Jim's big idea.

The Mailing List

Jim prepared a mailing list of every person for whom he had ever done any work. He jotted down on the cards the sort of a job he had done, the type of house it was and what he thought they should have in the way of electrical appliances. He also made a note of the number of special sockets he had installed, their location, and a word or two descriptive of the house and its occupants. Jim's cards looked something like this—

Name	W. J. Hardie
Address	9768 West Boulevard
Date work completed	July 15th, 1916
16 Lighting Sockets, 5 extras for Vacuum Cleaner, Iron, Dining Room.	
Mrs. H. does own work. Children, rugs and draperies; have laundry.	

This information on a 3 by 5 inch card gave him all the necessary information for the next step in the Big Idea.

Step number two took the form of a neat letter to his mailing list. He might pick out all those he considered "iron" prospects and write a letter on that appliance, or he might pick a vacuum cleaner, or a washing machine. His letters would be something on this order—

Dear Mrs. Hardie:—

One thing that struck me about your home while I was working there last summer was the wonderful help that a Westinghouse Vacuum Cleaner would be to you in your daily work. Your rugs and carpets can be cleaned in about half the time by its use and the job will not be so tiresome or wearing upon you as sweeping. In addition to cleaning the rugs a vacuum cleaner will keep your draperies clean, renovate pillows, and bedding, and do away entirely with the need of dusting.

You have noticed that with sweeping it is merely a matter of raising dust that settles almost as soon as you finish and makes your work all the harder. With a vacuum cleaner this is all stopped. You really take up the dirt and when you are finished the matted dust in the bag tells you a story of perfect cleaning.

I am writing you this letter today because Mrs. Hare will be in your neighborhood next Thursday and I should like to have her show you just exactly what sort of a help a Westinghouse Cleaner is.

I hope that you will be at home when Mrs. Hare calls. You will not be obligated in the slightest by listening to her story and there is every possibility that what you hear will do you a real service.

Yours for lessening housework,

Jim Hare.

Jim kept hammering away at his lists in this manner. If the house had just been wired he told about those extra sockets and the message they had for the housewife. He played her up strong. Electricity was not just light—it was lightened house work. He pointed out the value of a woman's time, the endless hours spent in doing things that electrical appliances could do better—and the beauty of it all was the fact that the women were all for him!

Regular Reminders

Jim's letters are now regular callers at the homes of his prospects. Regularly once a month—sometimes oftener—they get a reminder of the services that electrical appliances stand ready to offer. During holiday seasons, Christmas, Thanksgiving, Easter, July 1, Jim has some new way of tying his store and its wares into the spirit of the occasion. His strongest point is reminding the man of the excellence of things electrical as gifts—and the men appreciate and take advantage of the tip.

As we said at the beginning of this story (which, by the way, has a good broad strain of fact through it) Jim was just a normally ambitious chap, and that's the secret of his success. He was normal, he saw things as others see them, he saw the vast benefits others were reaping by the use of the mails and decided that what was good for others was equally good for him.

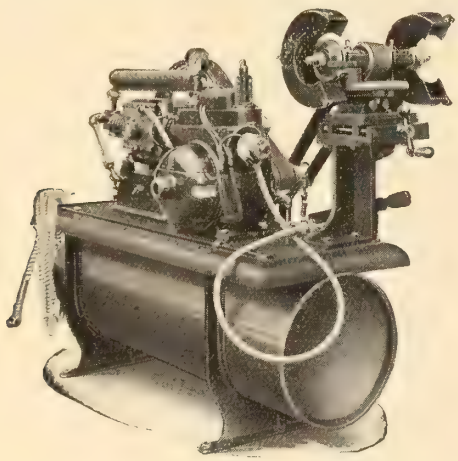
Jim was right. His demonstrating is now done by young ladies who know the business—Mrs. Jim saw to that. His mailing list includes those whose homes he wired—and lots that have been wired by other fellows. He also goes out after wiring business, telling the prospect what others say about electricity, how easily the wiring can be done without excessive damage and enclosing a reply card which gives the prospect an opportunity to find out just what the whole thing will cost.

They call Jim a successful man in his home town—and he is. The beauty of it all though is the way Jim tells his story and points out the moral. With a badly bent stogie rolling from one side of his mouth to the other, Jim leans back in his chair, half closes one eye and says, "So you want the secret of it, do you? Well, secrets cost a lot sometimes—this one of mine in particular. The prescription is some postage stamps, some letter-heads, some plain ordinary common-sense letters written on those letter-heads, and then a real live list of people to send those letters to."

Did you ever hear of a medicine easier and more pleasant

Electric Driven Combination Air Compressor and Buffing and Grinding Head

The United States Air Compressor Company, Cleveland, Ohio, have recently announced a new combination air compressor and grinder outfit which is especially suitable for service in garages and similar places where compressed air is required. The outfit consists of a self-oiling air compressor with filtering trap, check valve and safety valve, buffing head, 30-gallon tank, air pressure gauge, needle-point valve, pipe and fittings, armored hose, automatic air chuck, six feet of armored cable with plug, all mounted on a metal base to form a compact unit, which requires but 48 x 20 inches floor space. The height over all is 40 inches. The air compressor is the air-cooled, two-stage type. The low pressure cylinder is 3 x 3 inches in size and the high pressure cylinder is 1½ x 3 inches. The working pressure is 300 pounds per square inch, and the capacity of the compressor is 4 cubic feet per minute. The compressor operates at 250 to 300 r.p.m. It is provided with an intake silencer, which muffles the intake noise and tends to force air into the intake valve. When the air in the main tank is raised to the proper pressure the automatic switch stops the motor and operates the automatic pressure release, which opens starting tank to the atmosphere. When the automatic switch again starts the motor it also closes the pressure release, and the compressor begins pumping against no pressure. It always starts without strain. When the air in the starting tank attains a pressure slightly in excess of



that in the main tank (requiring about 10 seconds) it opens the check valve and charges this tank until the proper pressure is reached, when the operations are repeated. A trap is provided in the starting tank, which extracts any moisture or oil that may be discharged from the compressor, assuring pure, dry air, free from oil. The buffing and grinding head is suitable for wheels of 8-inch diameter. The outfit is equipped with a one horse-power Robbins & Myers motor, which permits the compressor and buffing head to operate at the same time. Outfits without this buffing head are equipped with a one-half horse-power R & M motor.

New Flood-Lighting Projector for Standard Mazda C Lamps

A new flood-lighting projector, designed for use of 300 to 1,000-watt standard Mazda "C" lamps, has been placed on the market by the George Cutter Company, South Bend, Ind. It is called the "Standard" Flood-Lighting Projector. The new unit has the same general construction features as the Cutter "Universal" projector for flood-lighting lamps. These features include weather and fume-proof body or housing cast of aluminum or grey iron and forming absolute protection for the lamp and reflector; method of mounting permits of the projection of light in any direction in any plane; construction of the housing permits of the interchange of narrow or wide-angle-beam reflectors; sectional wire-glass doors minimize breakage. In the new "Standard" projector the socket is adjustable both horizontally and vertically for focusing the lamp or changing the width of the beam; when the adjustment is made the socket is locked in position. Reflectors are made of copper, heavily silver-



plated and finished with a coat of water and fume-proof lacquer. The narrow-beam reflector has a divergence of 10 degrees and the wide-angle-beam reflector a divergence of 30 degrees. They are designed to redirect the maximum amount of light from the lamp. This projector is listed in Bulletin 3338, recently issued by the company.

Last Word in Small Motor Switches

Herewith are shown illustrations of two switch condulets of the ZY series—the latest additions to the large family of conduit fittings manufactured by the Crouse-Hinds Company of Canada, Ltd., with headquarters in Toronto. One of the country's leading mill engineers described these condulets as the "last word in small motor switches." Whether his verdict is true or not, the fittings certainly have very much to commend them in design and material as well as in workmanship. As safety first fittings, ZY condulets seemingly leave little to be desired. It is claimed for them that they protect the switch operator and the person renewing fuses from shock; they cannot be operated by accident; they withstand the roughest usage; water will not drain into them, and it is impossible for lint or other inflammable particles to lodge upon the current-carrying parts and thus create a fire hazard. Both the body of the condulet and its cover are cast iron. Inside is a combined 20-ampere snap switch and fuse block. The switch is externally operated, and its handle interlocks with the latch of the door in such a way that the latter cannot be opened when the switch is in the "on" position. As a result of this arrangement, the circuit is dead when the door is open, and fuses can be replaced without danger of shock or short-circuit. As the machine operator or any other person not skilled in electricity can change





fuses with perfect safety in ZY condulets, their use saves all the loss in productive time, which is unavoidable where an electrician must be sent for to replace fuses. This, in the course of a year, means a considerable saving in the operating time of the average mill. The manufacturers list ZY condulets in one and two-gang forms and in sizes and ar-

rangements of threaded conduit hubs to meet various conduit wiring arrangements. They have also issued a folder on ZY condulets which they will mail free to any address upon request.

Hubbell Shade Holders

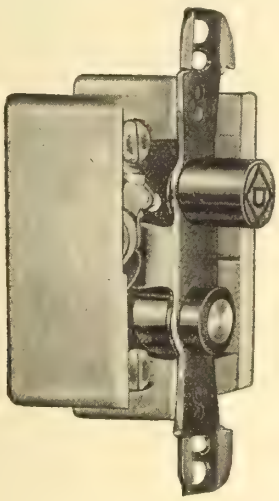
Harvey Hubbell, Inc., have placed on the market a line of brass shade holders of the three-screw type, for use with medium and mogul base weatherproof and porcelain sockets.



The attachment to the socket is accomplished by means of a clamp and screw arrangement. which guarantees a firm grip. The holders are given a bright dip and lacquered finish, making an attractive as well as useful device.

New Duncan Switch

The Duncan Electrical Company, Limited, of Montreal, manufacturers, are now offering a new push button flush switch in single pole and three way, called the Diamond D. These switches, as will be noted from the illustration, are so constructed as to have superb action, although only one inch deep. This shallowness is a splendid feature, as it allows ample room in box for wiring, which means easy installation. The Diamond D switches have been listed and approved by the Underwriters Laboratories of Chicago.



Toronto Electrical Contractors' Dinner

Following the regular monthly dinner of the Toronto Electrical Contractors' Association, held in the Walker House, Thursday evening, March 7, the members indulged in a lively discussion regarding the inauguration of a central bureau of reference and information. The need of such bureau was stated to be seen in the frequent practice of inviting tenders from a number of contractors merely to get a line on the probable cost of the work. Much valuable time was thus lost by the contractor without any chance of a corresponding advantage. It sometimes happens in such a case that one tender may be unusually low, due, not infrequently, to errors or omissions in figuring, and naturally such a tender is likely to be accepted, with disastrous results to the contractor. The idea of a central information bureau would be to enable the contractors to avoid these pitfalls. The details are being worked out by the executive, and a report will be presented at the next meeting.

Another question that received considerable attention was the licensing of contractors and journeymen. It is felt that the business has now reached a state where the safety of the public demands that irresponsible and unreliable men should be eliminated from this trade. Having this end in view, the executive were empowered to take such action as they thought fit.

The annual report of the St. Thomas Hydro-Electric Commission shows a total revenue of $98,393 for the year 1917. Of this amount $22,620 was derived from residence lighting, $14,843 from commercial lighting, $14,633 from street lighting, and the balance from sales of power, charging batteries. merchandise, and so on. A net surplus of over $5,000 was realized.

The Bell Telephone Company has cut in a new exchange at Lindsay, Ont. This replaces an old building.

Personal

Captain Richard P. Henry, late of the United States Army, has joined the selling forces of the Square D Company, Detroit, manufacturers of steel-enclosed safety switces, and has been appointed to the Indiana Territory, with headquarters at Indianapolis. Captain Henry spent three years at Purdue University, since which time he has been engaged in various branches of engineering work. His first position was that of assistant engineer for the T. H. I. and E. Traction Company, Terre Haute division. In 1912 he went with the Santa Susana Syndicate, Los Angeles, in the capacity of engineer and assistant geologist, and, later, entered the contracting business for himself, with offices at Chicago. He finally enlisted in the Engineering Corps of the United States Army, from which he was recently given an indefinite leave of absence on account of physical disability.

DOSSERT CONNECTORS

The Superintendent of one of the largest electrical contracting firms writes us:
"The workmen have formed the habit of using Dossert Connectors for all kinds of connections and consider it a hardship if they are called upon to perform the tedious and laborious task of making a soldered joint with its attendant acid fumes, gasoline torch smoke and burned fingers."

Ask the man who makes the joint!

DOSSERT & CO., 242 West 41st St., NEW YORK
H. B. LOGAN, PRESIDENT
IRVING SMITH, Canadian Rep., Unity Bldg., MONTREAL

Electrical Machinery and Repairs



Armatures Complete, Armatures Rewound, Armature Coils, Armature Shafts, Field Coils

Commutators New, Refilled or Assembled

Cleveland Armature Works
Cleveland, Ohio

Current News and Notes

Armagh, Que.

Work will proceed in April on a power development plant for the Armagh Electric Company, at Armagh, Que. A concrete dam will be erected, 62 feet high; reinforced concrete power-house; wooden penstock, 450 feet long, 36 inches diameter, and equipment will include 2 turbines and 2 generators of 200 h.p. each, 2,200 volts.

Brantford, Ont.

A contract has been awarded to the Canadian Westinghouse Company, Hamilton, Ont., for a motor for the sewage pumping station at Brantford, Ont.

Chatham, Ont.

The Dominion Sugar Company, operating a large plant at Chatham, Ont., have requested the Hydro-Electric Power Commission for a supply of 2,900 h.p.

Grand'Mere, Que.

It is reported that a number of business men of Grand'-Mere and Shawinigan Falls, Que., are organizing a company which will next month secure a federal charter and proceed with the construction of an electric railroad from Grand'-Mere to Shawinigan Falls. The distance is 9 miles, and the cost will be approximately $100,000.

Hamilton, Ont.

A Hamilton contractor was fined $10 recently for neglecting to take out a permit when installing some house wiring.

Kingston, Ont.

The Kingston electric railway was changed over to Hydro power on February 28.

London, Ont.

A 20-foot hole has been washed in the dam at Springbank, used by the London Public Utilities Commission to develop power during "peak" hours. Repairs will be impossible until more moderate weather sets in. The plant was capable of developing 500 h.p.

The London and Lake Erie Traction Company, operating an electric radial line between London and Port Stanley, have opened negotiations with a view to selling out to the city.

Montreal, Que.

The Bell Telephone Company's financial statement for the year 1917 shows gross earnings of $11,567,192, while net earnings amount to $2,534,071. Dividends totalling $1,440,000 were paid during the year and the surplus amounts to $533,-070. In his address the president, Mr. L. B. McFarlane, spoke of the difficulty of obtaining material during the year. Six thousand, six hundrd and ninety-one miles of wire were added to the long-distance system, increasing the total wire mileage to 82,716 on poles and 6.314 miles underground. The company have subscribed nearly a million dollars to the various war loans.

Ottawa, Ont.

The Ottawa Hydro-Electric Commission have announced a rate reduction of approximately 6½ per cent. Electric heating, it is stated, will now be available at a price equal to coal at $18 per ton.

Pterboro, Ont.

The Peterboro Utilities Commission announce an increase of $19,969 in the earnings of the Hydro-Electric Department in 1917, the total being $127,248. The net surplus amounted to $3,743.

St. Catharines, Ont.

At a recent meeting of the Niagara District Hydro-Radial Union, held in St. Catharines recently, the following officers were elected for the ensuing year: Honorary president, Sir Adam Beck; president, W. B. Burgoyne, St. Catharines; honorary vice-presidents, Dr. E. Jessop, M.P.P., Thomas Marshall, M.P.P., Dr. Jacques, M.P.P., Dr. Musgrove, M.P.P., Colonel Sharpe, M.P.P., J. T. Petrie, John Goodwin; first vice-president, W. G. Athoe, Ridgeway; second vice-president, L. B. Duff, Welland; treasurer, D. B. Crombie, St. Catharines; secretary, W. Charles Bush, St. Catharines.

Toronto, Ont.

In spite of the fact that the Toronto civic car lines are piling up a deficit each year, the Board of Control steadfastly refuse to increase the fares from two cents to three cents. The total deficit to the end of 1917 is said to be $590,688.

Earnings for the Toronto Street Railway Company during the month of February amounted to $509,650, as against $473,185 for the same month last year.

The Hydro-Electric Power Commission of Ontario are now receiving 20,000 h.p. from the Canadian Niagara Power Company, which they were deprived of for some time owing to the breaking down of two generators at the Canadian Niagara plant.

Vancouver, B.C.

The British Columbia Telephone Company have announced the number of telephones in use in Vancouver on February 1, 1918, to be 27,025. In October, 1915, there were 22,891 instruments installed.

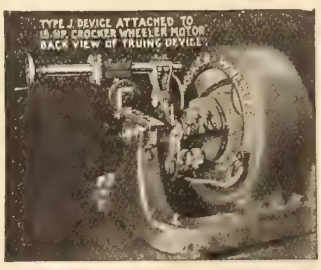
The Jordan Commutator Truing Device

Operates without removing armature. No shut down of motor or generator.

No large cuts from commutator and no unnecessary waste of copper.

No dragging of copper causing short circuits.

No portable slide-rest with the danger of the tool digging into the commutator and numerous other chances of damage to the commutator or armature which are all overcome with this machine.



JORDAN BROS., Inc., 74 Beekman St., New York

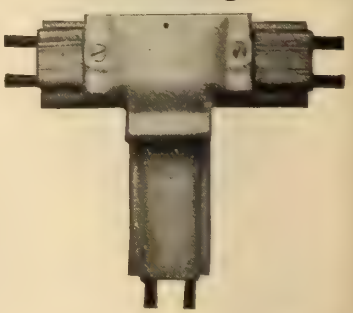
Represented by: Frank E. Filer, Winnipeg, Can.

Toronto Representative:
Canada Sales Company, 165 Church Street, Toronto, Canada

The Jordan Tapon for Moulding Work

A real time saver which means a Money Saver, making the best class of work.

It is not necessary to have the ends of the capping straight as the cover of the Tapon overlaps the capping, thereby covering any bad ends of capping.

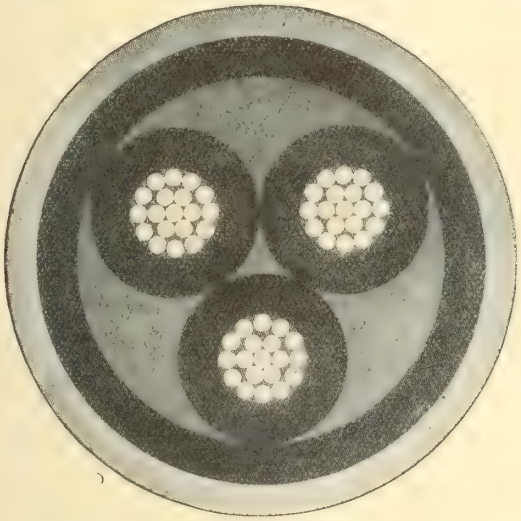


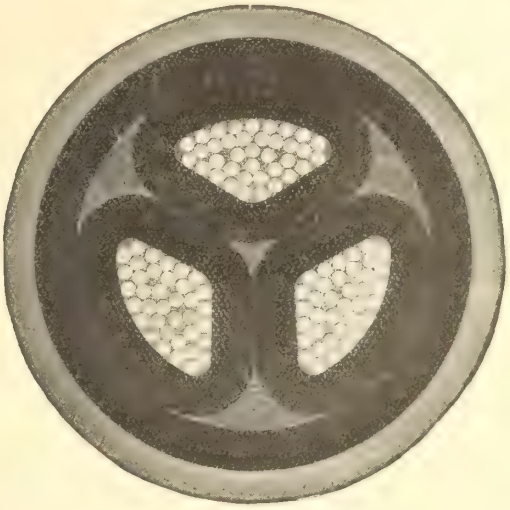
JORDAN BROS., Inc., 74 Beekman St., New York

Jordan Tapons may be secured from your nearest Electrical Supply House.

PHILLIPS' CABLES

as supplied to the Toronto Hydro Electric System





These illustrations show cross sections in the original size of cables recently supplied to the T. H. E. System and reordered by them for further extensions. The specifications are as follows.—Conductors composed of 37 strands each, .082 in. diameter. Thickness of dielectric on each conductor, .210 in. Thickness in belt, .210 in. Thickness of lead sheath, .160 in. Overall diameter, 2.61 in., 250,000 C.M. Three Conductor, Paper Insulated, and plain Lead Covered Cable for 13,200 volts. We can supply you with wires and cables of any size for Power, Lighting, Telephone, Telegraph, etc.

Write us for detailed information.

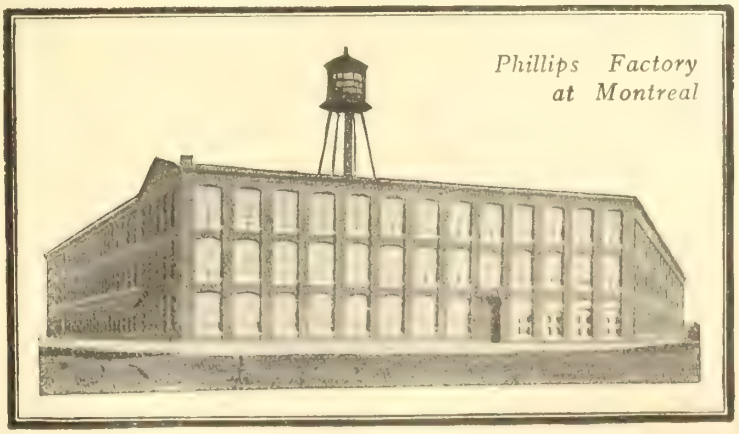
NOTE.—Specification of cable in left-hand cut: 3/0 B. and S. Three conductor. Each conductor 19 strands, each .094 in. diam. Thickness of dielectric on each conductor, .21 in. Thickness of dielectric on belt, .21 in.. Thickness of lead sheath, .15 in. Overall diameter, 2.60.

Specification of cable in right-hand cut: As stated in copy.

Eugene F. Phillips Electrical Works, Ltd.

Head Office and Factory: MONTREAL

Branches: Toronto Winnipeg Regina Calgary Vancouver



Phillips Factory at Montreal

PARLIAMENT BUILDINGS, OTTAWA

Tenders Wanted for Switchboards, Panel Boards and Transformers

Sealed tenders will be received by the undersigned until noon, **March 25, 1918**, for the Switchboards, Panel Boards and Transformers required in the reconstruction of the above building.

All tenders to be based on the execution, completion and delivery on the site, together with the furnishing of all material, tools, appliances, labor, etc., for the work as required and described by the plans and specifications for switchboards, panel boards and transformers.

The work of this contract shall be proceeded with immediately upon the signing of the same and continued as directed, in such a manner as to insure the completion thereof by August 31, 1918.

Plans and specifications, and any other information required can be obtained at the office of the General Contractors, P. Lyall & Sons Construction Company, Limited, Ottawa.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Minister of Public Works, for a sum not less than five per cent. (5 p.c.) of the amount of the tender, which will be forfeited if the parties tendering decline to enter into a contract when called upon to do so. If the tender is not accepted the cheque will be returned. If the tender is accepted an additional cheque for a sum equivalent to five per cent. (5 p.c.) of the amount of the tender must be deposited before the contract is signed. The total security will be forfeited if the contractor fails to complete the work contracted for.

Certificates of payment shall be issued monthly as the work progresses and shall not exceed in the aggregate ninety per cent. (90 p.c.) of the value of the labor and material furnished and set out in the work.

The lowest or any tender not necessarily accepted.

Envelopes containing tenders to be marked, "Tender for Switchboards, Panel Boards and Transformers, and addressed to the undersigned.

JOHN A. PEARSON, Architect.
J. O. MARCHAND, Associate.
Parliament Buildings, Ottawa.



Generator Set Wanted

Wanted—35 to 50 K.W. 125/250 volt 3 wire D.C. Generator, direct connected to High Speed Engine. Write The Kaufman Rubber Co., Ltd., Kitchener, Ontario. 5-8

For Sale Cheap

85 Kw. Westinghouse, 250 Volt, D. C. Generator, 750 R.P.M. First class condition. Write to

The KAUFMAN RUBBER CO., Limited,
3-6 Kitchener, Ont.

Here's How One Dealer Drew Crowds to His Store

Acting on the theory that human curiosity can be aroused to good advantage by injecting an element of mystery into the window display, a dealer applied a variation of the ever-flowing bottle principle to a Westinghouse 5-cup percolator in his window. It took two people to keep the crowd back long enough to take a picture, after the feature had been in operation four days. The liquid is pumped up a glass tube bent to the shape of a stream flowing out, and runs down the outside of the tube.

PETRIE'S LIST

of New and Used

MOTORS

for Immediate Delivery

No.	H.P.	Phase	Cycle	Volts	Speed	Maker
1	50	3	25	550	850	Westg.
1	40	3	25	550	750	C. G. E.
1	40	3	25	550	710	Westg.
1	25	3	25	2000	900	C. G. E.
1	7½	3	25	550	1400	Westg.
1	7½	3	25	550	720	Westg.
2	7½	3	25	550	750	C. G. E.
1	5	3	25	550	1440	Excelsior
1	5	3	25	550	1400	Westg.
2	4	3	25	550	1400	Excelsior
2	3	3	25	550	1400	Excelsior
2	3	3	25	550	750	C. G. E.
2	2	3	25	550	1400	Excelsior
1	2	3	25	550	750	C. G. E.
1	1	3	25	550	1450	Excelsior
1	¼	1	60	110	3400	Diehl

Write Us for Prices

H. W. PETRIE, Limited

Front St. West - Toronto, Ont.

NOTICE

IMMEDIATE DELIVERY

FOLLOWING
FIRST CLASS EQUIPMENT TO BE SOLD IMMEDIATELY AT VERY LOW PRICES

GENERATORS

No.	K.W.	Cycle	Phase	Volt	Speed	
1	100	60	3	550	900	($1500.00)
1	75	60	3	2200	900	($1500.00)
1	50	60	3	550	1200	($1000.00)
1	300	60	3	2200	600	
1	250	Dir. Current		250	425	
1	100	Dir. Current		250	600	
1	85	Dir. Current		250	800	
1	35	Dir. Current		250	400	
1	17	Dir. Current		250	1100	
1	20	Dir. Current		125	550	
1	17	Dir. Current		125	1100	
1	12½	Dir. Current		125	850	

MOTORS

5 to 100 H.P., 125 and 250 Volt, Direct Current.
5 to 300 H.P., 60 and 25 Cycle, All Voltages.
Transformers of all types.

Write or Wire if you are in the market to buy or sell equipment.

E. A. LOWRY
209 King St. - GUELPH, ONT.

PROCURED IN ALL COUNTRIES
LONG EXPERIENCE IN PATENT LITIGATION

SEND FOR HAND BOOK

PATENTS

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RIDOUT & MAYBEE

59 Yonge Street
TORONTO - - - CANADA

Rubber Covered Wires and Cables

FOR POWER, LIGHT AND TELEPHONE WORK

Incandescent Lamp Cord, Flexible Switchboard Cables, Special Cords and Cables for all kinds of Electrical Work.

Prompt Shipments from Canadian Factory.

BOSTON INSULATED WIRE & CABLE CO., Limited

Canadian Office and Factory, HAMILTON, ONT.

3 Phase, 25 Cycle, 220 volt Motors

Immediate Delivery

No.	H.P.	Make	Speed	Type	Form
1	100	General Electric	500		
1	50	Allis-Chalmers	750		
2	50	General Electric	720		
1	50	General Electric	500	I	K
1	35	General Electric	750	I	K
1	35	General Electric	1500		
3	25	General Electric	750	I	K
1	20	General Electric	750	I	K
1	15	General Electric	750	I	K
6	10	General Electric	750	I	K
7	5	General Electric	1500	KT	C

3 Phase, 25 Cycle, 220 volt Motors

Ready for Delivery in March

No.	H.P.	Make	Speed	Type	Form
1	200	General Electric	500	I	K
1	150	Westinghouse	485		C
1	100	General Electric	750	I	K
2	60	General Electric	750	I	K
11	3	General Electric	1500	KT	
6	2	General Electric	1500	KT	

JOSEPH MYERSON

274 Commercial St. - BOSTON, MASS.

Selections from Our Stock of Motors

3 PHASE, 60 CYCLE MOTORS

Qu.	H.P.	Make	Volts	Type	Speed
2	½	G.E.NEW...	110	KT	1800
1	1	Fbks. M. ..	440	B	1200
2	3	R&M NEW.	220		1150
6	3	Wstgh. New	220	CS	1130
2	2	G.E.	220	KT	900
4	3	G.E.	220	KT	1800
1	3	G.E.	220	KT	900
3	3	G.E.	220	KT	1200
2	5	G.E.NEW. .	220	KT	1800
3	5	Wstgh. New	220	CS	1130
1	5	G.E.	220	KT	1200
1	5	Wstgh.	220	CCL	1700
3	5	Cr.Wh. .. .	220	Q	1720
1	5	Wstgh.	220	CCL	1700
10	5	Wstgh. New	220	CS	1735
1	7½	G.E.	220		1800
29	7	C.G.	550		1200
1	7½-15	Cr.Wh..	220/440		865/1735
4	7½	G.E.NEW. .	220	KT	1800
4	7½	G.E.NEW. .	220	KT	1200
6	7½	G.E.	550	KT	1800
2	7½	G.E.NEW. .	220	KT	900
2	10	G.E.NEW .	220	KT	1800
1	10	Wstgh.	220	CCL	1700
1	10	Wstgh.	220	CS	1150
1	10	Cr.Wh. . ..	550	Q	1800
3	15	R&M	220		1150
4	15	Fbks.M.	220/440	KBV	1200
1	15	Wagner sl.rg. no controller ...	220/440	TBR	1200
2	20	Wstgh. . .	220	CS	1160
1	20	Fbks.M. . .	220	B	1200
50	20	Fbks.M.	220/440	KBV	1200
20	25	Wagner	220/440	BP	1120
1	25	G.E. sl. rg. no controller . . .	220	M	900
2	30	WagnerNEW	220		850
1	35	Triumph	220/440		900
1	35	G.E.	220	KT	600
1	35	G.E.	220	KT	720
1	40	Wagner NEW.	220/440	BP	850
1	40	Fbks.M. . .	220		900
1	40	G.E.NEW .	220	KT	1200
1	50	Triumph . .	220		720
1	50	G.E.NEW. .	220	KT	900
2	50	G.E.NEW .	440	KT	900
1	50	G.E.NEW..	220	KT	1200
1	50	G.E. sl. rg.	220	M	900
1	75	G.E.NEW. .	220	K	900
1	125	G.E.	2200	L	600
1	150	Wstgh. New	440	CW	695
1	263	G.E. Synch. with direct connected exciter.....	2200		660

3 PHASE, 25 CYCLE MOTORS

Qu.	H.P.	Make	Volts	Type	Speed
1	5	G.E. . . .	220	KT	750
1	12½	G.E.elev.type-high torque	220	KTE	750
6	15	Allis-Ch. ..	220		750
7	20	Allis-Ch. ..	220		750
2	20	G.E.	440	K	750
1	40	Wstgh. . .	220	MW	695
1	50	Allis-Ch. intermittent duty, sl. rg. drum controller	440		500
1	55	Wstgh.sl.rg. 30 cycles, complete. .	440		860
1		60/45/30 G.E.	440		500/375/250

GEORGE SACHSENMAIER & CO.

Office and Salesrooms: 141-43-45 N. Third Street.
Warehouses: 928-30-32 N. Third Street,

PHILADELPHIA

Generator For Sale

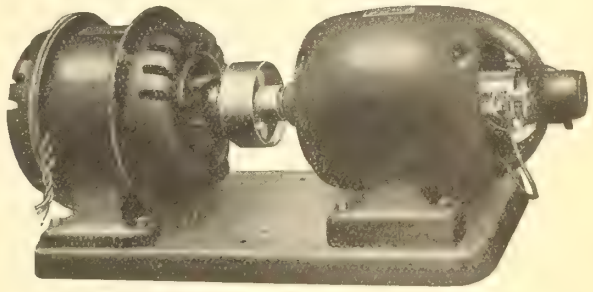
We have for sale, one 60 Cycle, 2300 Volt, 60 K.W. 3 phase Generator, Belt Drive, 1200 r.p.m. Direct Connected Exciter.

Ready for immediate delivery

Power Plant Equipment Co.

Dominion Bank Building

Toronto



Motor Generator for Charging Batteries

Motor Generators and all Electrical Machinery

Write for prices and send your repairs to

Toronto & Hamilton Electric Co.

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Built to order

¶ With twenty-four years' experience, a modern factory, and a staff of specially skilled engineers, we are equipped to design and build transformers for special work.

¶ If you have an unusual transformer problem call on us.

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The Contract Record

would result in additional competition, which might save your city or town or your client many hundreds of dollars.

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Galvanized Conduit

is

MADE IN CANADA

and sold by

CANADIAN JOBBERS for CANADIAN TRADE

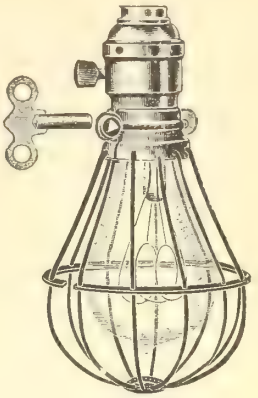
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Are Your Lamps Imprisoned?

THE LOXON INVENTION



prevents loss by theft or breakage.

Get our list describing the Loxon Lamp Guards, and giving prices and particulars of this and many other Electrical Specialties.

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Electrical Machinery

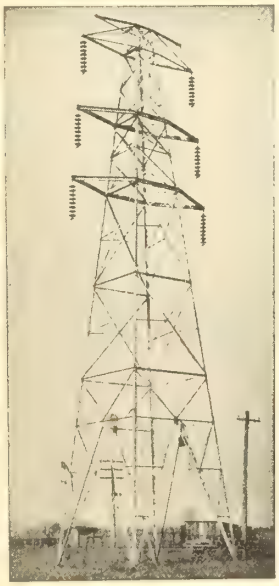
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J. & M.	550	25	3	15
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Westinghouse	550	25	3	5
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and
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Lines

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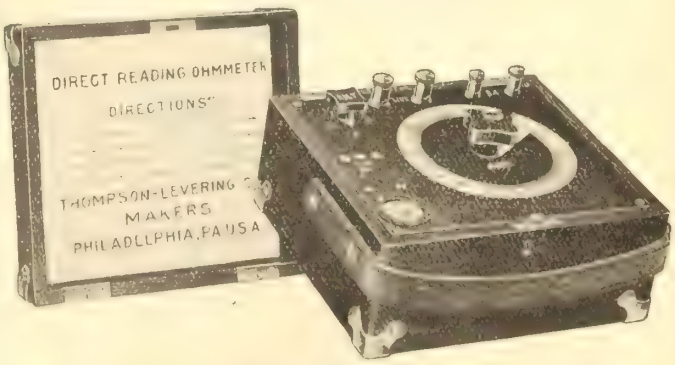
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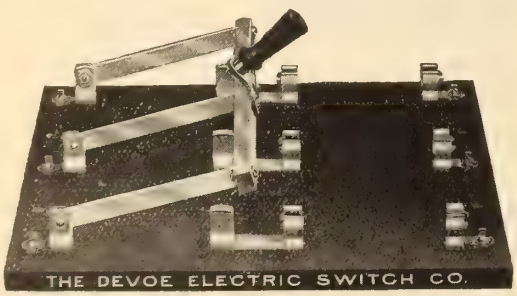
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Hundreds of Contractors are using them. You'll never know how good they are until you try them, and now's the time to do it.

We are equipped to build special switches to any specification. As specialists in this line we are able to produce all kinds of switches at reasonable prices.



Send us your specifications and we will quote you price.

WRITE FOR OUR NEW CATALOG NO. 7

The Devoe Electric Switch Company

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The REFLEX Line of Spark Plugs is a trade winner. They are made right—stay clean and keep the car on the go. A Gold Bond guarantee against defective material and workmanship is given with each plug.

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Write for full particulars.

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Black, quick air-drying insulating composition. Also supplied for stoving, and as a solid insulating compound.

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"ARMABRON"
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The Portable Welder is a new device for installing the time tested

ERICO WELDED BONDS

It can be easily lifted from the track by two men. There are no rotating parts and no flame or arc strikes bond or rail.

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We can meet your requirements, however large, promptly.

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Montreal Toronto Hamilton Seattle

Full load to full speed in 2 to 10 seconds—this quick acceleration minimizes the drag on the circuit and together with the low starting current permits of the 1/10 to ¼ horse power sizes of

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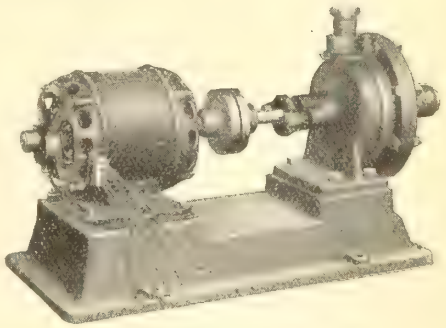
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being installed on lighting circuits

A fuse which will protect under full load is usually of ample capacity for successfully starting the ordinary full load.

Other sizes up to 40 Horse Power, 25 to 140 Cycles.



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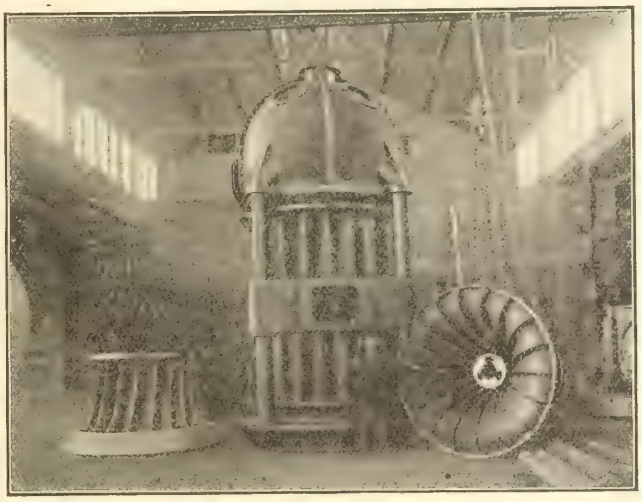
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Hydraulic Governors

High Efficiency Pumps



Vertical Turbines

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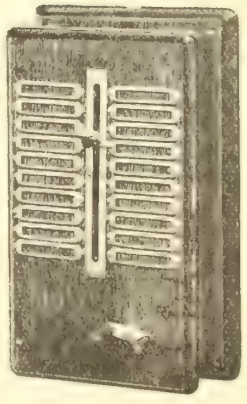
The services of these experts are at your disposal to consult on any of your engineering troubles.

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It is easy to lose track of a man in a plant of more than two departments. Just when you want him you cannot find him. Sometimes important matters are delayed while you are looking for the man that knows the details.



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in a plant is also easy after you have installed a Presto-Call System. The Presto-Call is a Signal Service that we make in three sizes to call 5 men, 10 men or 20 men. It is easy to operate, and moderate in price; works with either vibrating or single stroke bells, or horns. The Presto-Call pays for itself in a few months.

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(Continued on Page 48)

SQUARE D

STEEL ENCLOSED MOTOR STARTING SWITCHES

TO-DAY'S industry will influence the nature of our future peace. Maximum production is a vital necessity. Conditions demand the best in mechanical equipment. Machinery must be kept busy—shut-downs be avoided.

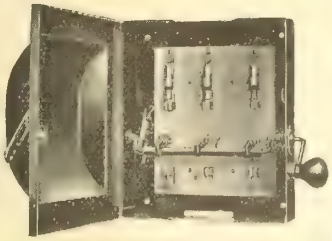
The Square D trade mark identifies THE ORIGINAL Safety Switch. Square D Motor Starting Switches, because of superior mechanical design and substantial construction, not only make your machines safe-starting but also help you to avoid costly interruptions of service.

Don't trifle with imitations.

Square D Company

Walkerville, Ont.

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SQUARE D SWITCHES DO NOT HINDER PRODUCTION

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Chamberlain & Hookham Meter Company
Devoe Electric Switch Company
Electrical Development & Machine Company
Electrical Maintenance & Repairs Company
G. & W. Electric Specialty Company
Hatheway & Knott, Inc.
Moloney Electric Company of Canada
National Metal Molding Company
Northern Electric Company
Sundh Electric Company

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Canadian Westinghouse Company
Crouse-Hinds Company of Canada, Limited.
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Ferranti Electrical Company of Canada
Moloney Electric Company
Northern Electric Company
Pringle, R. E. T.

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Ferranti Electrical Company of Canada

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Northern Electric Company

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National Electric Heating Company
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Northern Electric Company

R.C.O.C. CONTROL *now more efficient than ever*

IMPORTANT NEW FEATURES ADDED

A COMBINATION LEVER ATTACHMENT permits closing switches by hand to locate burnt-out lamps, avoid outages, etc. The load may be put out of service where White Way Systems are used only on certain nights. Where switches are put out of step they can immediately be stepped ahead. Just move a lever—that's all there is to do. Complete control is in your hands, at the power house and at each switch if required.

A NEW 2-IN-1 CASE is now provided for the Pole Type and Subway R.C.O.C. Switches. Where manhole space is limited this feature is of no small importance, for two switches in this new case take up little more room than the single switch case, conserving space and weight on pole line installation.



HERE IS WHAT R.C.O.C. CONTROL ACCOMPLISHES: At the Power House, using the regular series street circuit for the control wire, the operator controls series White Way systems having combinations of all-night and short-hour lamps on the same circuit; or multiple White Way Systems having all-night or combination all-night and short-hour lamps on the same circuit; or bridge, alley, sign, pump-motor circuits; or (a most important point) pole type or subway Constant Current Transformers controlling loops of series-circuits.. Watchmen, patrolmen, time switches and irregular lamp hours are things of the past in R.C.O.C. installations.

Write us to-day regarding your control problems

SOUTH BEND CURRENT CONTROL CO.

111 W. Colfax Ave. SOUTH BEND, Ind.

Canada Wire & Cable Co., Limited
Head Office and Works, TORONTO

Bare and Insulated Electrical Wires for all purposes

Electric Railway Trolley Wire and Feeder Cable

Sales Offices and Branch Warehouses:
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Prompt shipments from Factory or nearest Warehouse

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FOR EVERY PURPOSE
THORDARSON ELEC. MFG. CO., CHICAGO

Farms,—Country Houses and Isolated Plants
Requiring Storage Batteries

should buy same from the C. H. A. Company.
Our works at St. Johns, Quebec make and supply Electric Batteries of all kinds.
Batteries for lighting Towns or Electric Trucks.
Get our prices. We can save you 35% customs duties. A test purchase will prove that ours are the

Cheapest Storage Batteries in Canada

Secure prices today from the

Canadian Hart Accumulator Co., Limited
Head Office and Works
ST. JOHNS, - QUE.

Makes Stronger Splices

Use a flux that is equal to "50-50" soder and pure copper wire—the kind that holds without starting corrosion. That's

ALLEN Non Acid Sodering Flux. 4 forms: Stick, paste, salts and liquid.

Sample for your Dealer's Name.

—the quality flux. Makes perfect unions without biting the metal.



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22 College Street, TORONTO
1825 Scarth Street, REGINA
"In Soderman's game since '93"

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ELECTRICAL CONDUCTORS

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Northern Aluminum Co., Limited
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Inspection at point of manufacture of Power Plant Equipment, Wire, Cable, etc.
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ESTABLISHED 1849
BRADSTREET'S
Offices Throughout the Civilized World.
Executive Office:
Nos. 346 and 348 Broadway, New York City, U. S. A.

THE BRADSTREET COMPANY gathers information that reflects the financial condition and the controlling circumstances of every seeker of mercantile credit. Its business may be defined as of the merchants, by the merchants, for the merchants. In procuring, verifying and promulgating information no effort is spared, and no reasonable expense considered too great, that the results may justify its claim as an authority on all matters affecting commercial affairs and mercantile credit. Its offices and connections have been steadily extended, and it furnishes information concerning mercantile persons throughout the civilized world.

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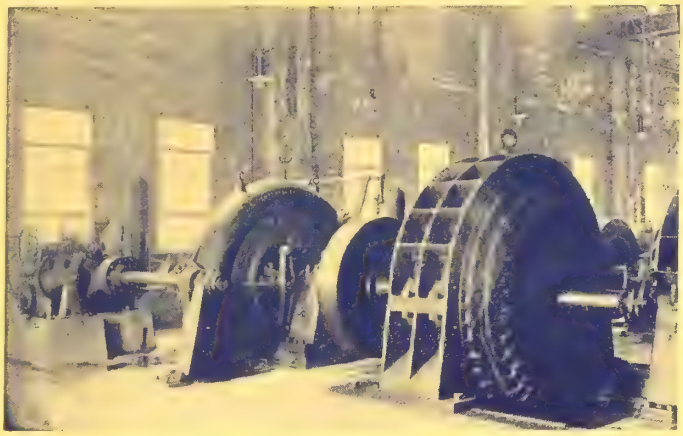
THOS. C. IRVING,
Gen. Man. Western Canada, Toronto

A Lost Opportunity

As a wiring contractor, how many times have you turned down orders to repair the Motors or dynamos of your customers and let them send their work to the maker?

How much have YOU lost in prestige through not being able to take care of your customers' business?

How much have YOU lost in Profit on this business?



Get the habit of handling these repairs. Send them to a **Specialist in Repairs.** Don't send them to the maker. Your customer can do that, and he's already sick of it. The service is too slow. He wants **quick work** and an **absolutely reliable job. You can give it to him.**

Make up your mind **now.** Say **"I'm going to get something out of the next repair job in this town."**

You have the work of taking out and re-installing the machine **(Profit).** Send us the machine or part with a description of its action or symptom. We'll rush it through for you, give you an A1 job and you come in again on the **Trade Discount (More Profit).**

Others are doing it. Why not you? Write about it.

The Electrical Maintenance & Repairs Company, Limited

Phones:
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162 Adelaide Street West, Toronto
"ALWAYS ON THE JOB"

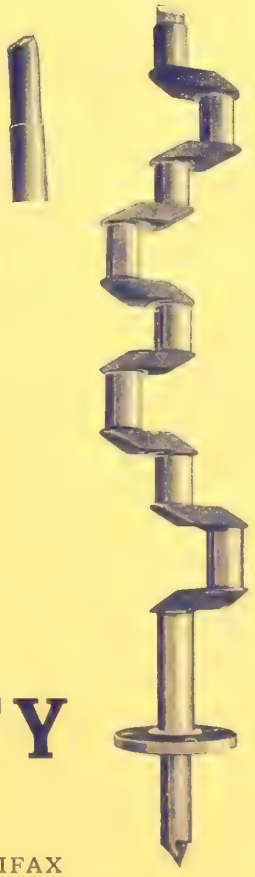
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Oxy-Acetylene Welding

Speeds up Production - Conserves Material



Automobile Crank Shaft successfully reclaimed by Welding



Whenever a problem arises involving the joining of metals (whether for manufacturing purposes or repairing broken equipment) Oxy-Acetylene Welding is almost invariably the solution.

No plant, however well equipped otherwise, is complete without an Oxy-Acetylene Welding Outfit to take care of the everyday repair jobs that a speeding up of production entails; and is absolutely imperative in order to completely avoid the disastrous consequences that must inevitably follow a serious breakdown, and the inability to obtain replacements.

We shall be pleased to give you all particulars as to the benefits to be derived from the Process in your Industry, without obligation, and your interest will be appreciated.

L'AIR LIQUIDE SOCIETY

The Pioneers of the Process throughout the world

Canadian Factories

TORONTO MONTREAL WINNIPEG HALIFAX

Self-Starting Induction Motors





Continuous Service. Single Phase.
25 Cycles.

H.P.	Speed Synch. R. P. M.	Frame No.	Code	Shipping Weight
1/50	1500	A-00	Sar	25
1/30	1500	A-0	Sen	26
1/15	1500	A-1	Sul	26
1/10	1500	A-2	Tic	38
1/6	1500	A-3	Tup	45
1/3	1500	A-4	Cure	62
1/2	1500	A-4		



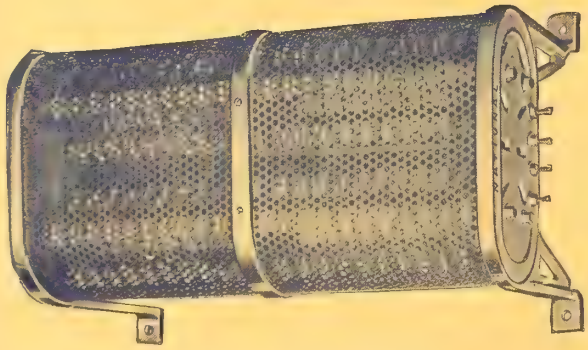
For 220 volt add "LY" to code.

Prices for any voltage upon request.

R. E. T. PRINGLE, LIMITED

95 King St. East **TORONTO**
302 Donalda Block **WINNIPEG**
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Central Stations



10 K. W. Type LW Heater.

Heat your buildings on your off peak load by electricity.

Conserve more coal.

National ELECTRIC **Heaters**

are built in many sizes suitable for all requirements

Write us for further information

The National Electric Heating Co., Ltd., Toronto

Vol. XXVII No. 7 Toronto, April 1, 1918

Electrical News

Generation, Transmission and Application of Electricity



MR. GEORGE A. HUGHES
President Hughes Electric Heating Co., Toronto

The Man who has made it possible

THE AMERICAN FUEL ADMINISTRATOR SAYS WE MUST SAVE 50,000,000 TONS OF COAL IN 1918

Coal Tonnage, Coal Car Congestions, Coal Wagon Blockades Relieved by Use of Electric Cooking Ranges and other Electric Household Devices.

USE of coal in kitchen ranges has been one cause of this winter's coal shortage and traffic congestion. It is estimated that, where the average family consumes 800 pounds of coal monthly for cooking, the central station requires only 262.5 pounds of coal monthly in order to supply this family with ample cooking current.

Moreover, coal cartage to homes, entailing car switching to numerous retail coal yards, and with the unavoidable stalling of coal wagons in congested streets, results in delays in loading and unloading cars of merchandise of all classes.



Electric cooking in homes helps solve these two problems. Where central stations operate from water-power, the entire coal consumption and coal transportation problems are eliminated. Where they operate from coal, they save the country over three tons of coal per family annually, they cut down car switching, and do away with the bulky, slow wagons.

Also, there is less shrinkage of food with electric cooking than with any other cooking process.

There is every domestic reason in favor of electric cooking—better food, greater cleanliness, less work, and more comfort—**no ashes, no smoke, no dust.**

The use at this time of electric ranges and household devices will help to meet the present national needs in the saving of fuel, labor, time, and transportation.

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FIGURE 3



FIGURE 1—FRONT FIGURE 2—REAR

THE "S.J.B." BOX

FOR SERIES ORNAMENTAL STREET LIGHTING SYSTEMS

¶ To provide a means of disconnecting lamps from circuits supplied with current by two-conductor cable, The Northern Electric Company have recently designed the "S.J.B." Box for use on series circuits operating at potentials of 7,000 volts or less.

¶ Figs. 1 and 2 show front and rear views of the box, and Fig. 3 shows how the box is installed in the pedestal of a lamp standard. This view was taken in Montreal where all of the standards used in connection with the new lighting system are equipped with these boxes.

¶ There are many interesting features in connection with this box, but the limited space at our disposal does not permit of a detailed explanation. To those interested, however, we will be glad to send photographs and full descriptive matter on application to our nearest branch house.

Northern Electric Company
LIMITED

MONTREAL HALIFAX TORONTO WINNIPEG
REGINA CALGARY VANCOUVER

Quality Line-Construction Material



—for Your Spring Construction Work

Northern Electric

Poles	Pins	Lag Screws	Cable Rings
Crossarms	Braces	Pole Steps	Anchors
Brackets	Bolts	Guy Clamps	Insulators
	Wires	Strand	

The Quality of NORTHERN ELECTRIC material is assured by rigid manufacturing Specifications and inspection.

Service, an important item in your work, is assured through our representative distributing houses from coast to coast, where large stocks are carried and available for rush orders.

Northern Electric Company

LIMITED

HALIFAX	TORONTO	REGINA
MONTREAL	LONDON	CALGARY
OTTAWA	WINNIPEG	VANCOUVER



222
TWO WIRE ONLY

333
THREE AND FOUR WIRE

Inter-connecting Metal Moldings

No. 222 is a neat molding easily installed. Connections to fittings are made without screws. Wires "stay put" when laid in. Capping is secured with Spring Clips after all connections are made and the system tested.

No. 333 has not been changed in design. It will carry a three-wire circuit or two two-wire circuits. Through the use of simple fittings, is inter-connecting with No. 222 Systems.

Either or both make a good looking job and a good job.

Complete Descriptive Bulletin 101 sent on request.

National Metal Molding Co.

1118 **Fulton Building, Pittsburgh, Pa.**

Atlanta, Boston, Buffalo, Chicago, Dallas, Denver, Detroit, Los Angeles, New York, Philadelphia, Portland, Salt Lake City, San Francisco, Seattle, St. Louis, Buenos Aires, Havana, Manila, Paris

CANADIAN GENERAL ELECTRIC COMPANY, LIMITED—CANADIAN DISTRIBUTORS

M5

XCELADUCT

Galvanized Conduit

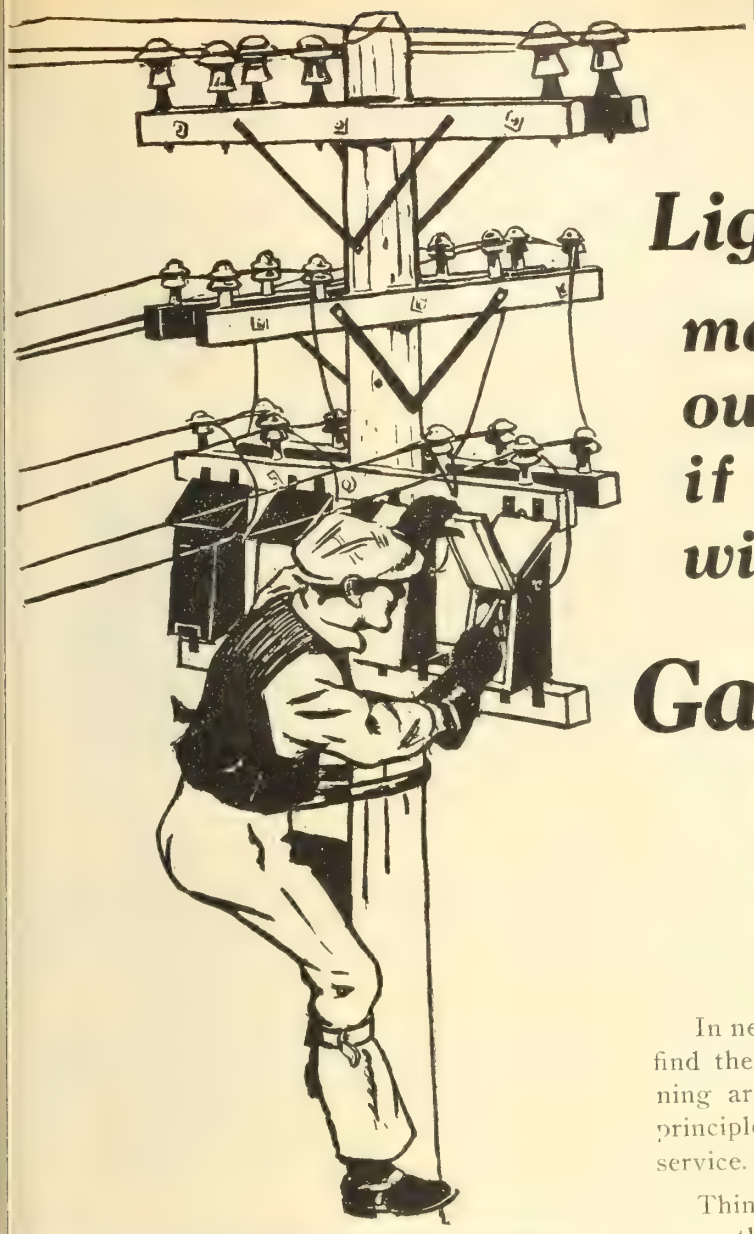
is specified

By all Leading Engineers and Architects throughout Canada

Labelled under inspection by the Underwriters' Laboratories, Inc.

Orpen Conduit Co., Limited

Toronto



Lightning Flashes

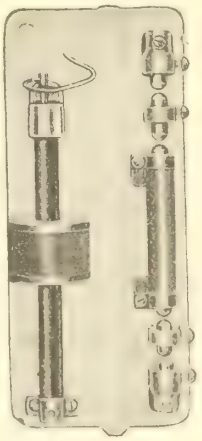
may instantly burn out your apparatus if not protected with—

Garton-Daniels Lightning Arresters

In nearly every station, on nearly all lines, you find the Garton-Daniels—the one type of lightning arrested that has remained unchanged in principle through more than a quarter century of service.

Think of it! For over 25 years they have been protecting many millions of dollars' worth of electrical apparatus. And they have been doing it right, because their small air-gap distance, low series resistance and positive mechanical circuit breaker form a combination which is the most efficient and reliable lightning protective unit known.

And right now, before lightning flashes actually interrupt your service and probably burn out some apparatus, it is indeed the time to consider lightning protection and buy sufficient Garton-Daniels Lightning Arresters to protect all of your apparatus.



Typical Station Type A.C. Arrester

WRITE FOR QUOTATIONS.

Electric Service Supplies Co.
Manufacturers
PHILADELPHIA 17th and Cambria Sts. NEW YORK 50 Church St. CHICAGO Monadnock Bldg.

Lyman Tube & Supply Co., Ltd.
Canadian Distributors
MONTREAL Lyman Tube Bldg. WINNIPEG 302 Donalda Block TORONTO 33 Melinda St.

REFLEX Spark Plugs



The REFLEX Line of Spark Plugs is a trade winner. They are made right—stay clean and keep the car on the go. A Gold Bond guarantee against defective material and workmanship is given with each plug.

Every customer satisfied — profits sure—a good line to handle for winning the good-will of motorists and users of engines.

Get the "Reflex" Agency.

Write for full particulars.

Great West Electric Co., Limited
61-63-65 Albert St., Winnipeg, Man.

Stability and Efficiency

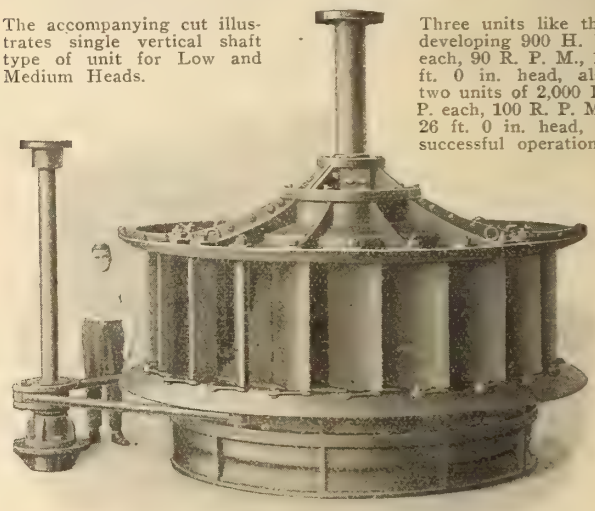
are prime factors in development of Water Power in these days of intense activity.
That's why

SMITH HYDRAULIC TURBINES

are being installed in the "PLANTS THAT COUNT"

The accompanying cut illustrates single vertical shaft type of unit for Low and Medium Heads.

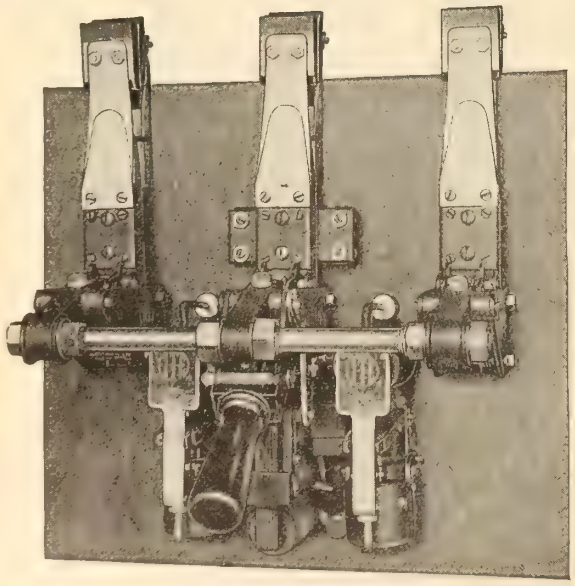
Three units like this developing 900 H. P. each, 90 R. P. M., 15 ft. 0 in. head, also two units of 2,000 H. P. each, 100 R. P. M., 26 ft. 0 in. head, in successful operation.



Write Department "N" for Bulletin of Designs and Useful Data for Hydraulic Development.

S. Morgan Smith Co., York, Pa.
H. B. Van Every, Canadian Representative, 405 Power Bldg., Montreal

I-T-E CIRCUIT BREAKERS



TYPE W

Non closable on overload. Direct acting, time limit and "No Voltage."

For motor protection, especially A.C., 440 volts or less, the

I-T-E CIRCUIT BREAKER

has advantages not possessed by any other piece of apparatus. This is why one concern recently ordered over two hundred of them.

THE CUTTER COMPANY

Bank of Hamilton Building, Toronto
Main Office and Factory: Philadelphia, Pa.

New York, 50 Church St. Chicago, Monadnock Block.
Detroit, Mich., Ford Bldg. Pittsburgh, Park Building.
Indianapolis, Ind., Telephone Bldg. Minneapolis, Metropolitan Life Bldg.

ECCLES & SMITH COMPANY
Los Angeles San Francisco Portland, Ore,

Railway & Power Engineering Corporation

Limited

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Power Bldg.
Tel. Main 5667

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Can. Pac. Ry. Bldg.
Adelaide 2675

Railway, Light and Power Equipment

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WE REPRESENT

Bates Expanded Steel Truss Company
CHICAGO, ILL.

Steel Poles for Railway, Light and Power Purposes. Outdoor Type Substations.

Catskill Foundry & Machine Works
CATSKILL, N.Y.

Steel Gears and Pinions

Columbia Machine Works & Malleable Iron Co.
BROOKLYN, N.Y.

CAR EQUIPMENT

Armature and axle bearings
Armature and field coils
Bearings (bronze and iron)
Brush-holders and brush holder springs
Brake, door and other handles
Brake forgings, riggings, etc.
Car trimmings
Commutators
Controller handles
Forgings of all kinds
Gear cases (steel or malleable iron)
Grid resistors
Third-rail shoe beams and accessories
Trolley poles (steel) and wheels

TOOLS

Armature and axle straighteners
Armature shaft straighteners
Armature buggies and stands
Babbitting molds
Banding and heading machines
Car hoists
Car replacers
Coil taping machines for armature leads
Coil winding machines
Pinion pullers
Pit jacks
Signal or target switches
Tension stands

Special Shop Working Tools.

Laclede Steel Company
ST. LOUIS, Mo.

"Electroheat" Axle and Armature Shafts of all types and sizes. "Electroheat" Annealed side rods, main rods, crank pins, piston rods. All kinds of "Electroheat" Forgings, etc.

Morgan Crucible Company
NEW YORK

Carbon Brushes.

Railway Track Work Company
PHILADELPHIA

The Rèciprocating Track-Grinder.

Westinghouse Electric and Mfg. Company
PITTSBURGH, Pa.

Trolley and Catenary Construction Material.

We also handle electric passenger, freight, and express cars and locomotives of all types and descriptions.

Keep this list before you whenever you are in the market for equipment and supplies.

All engineering service without obligation. List will be continued in next issue.

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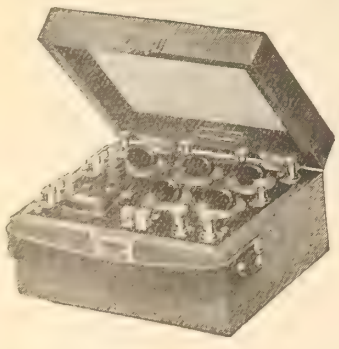
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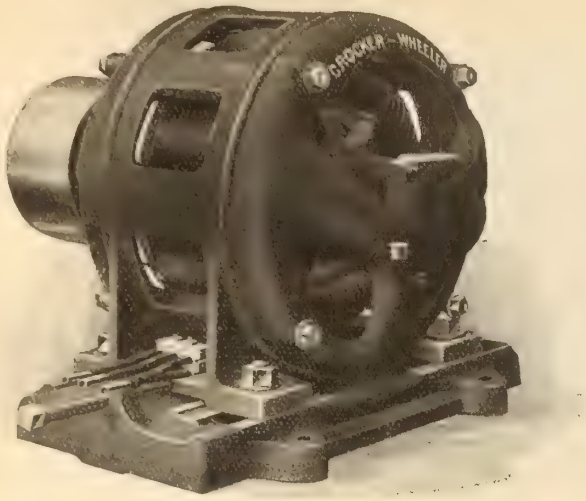
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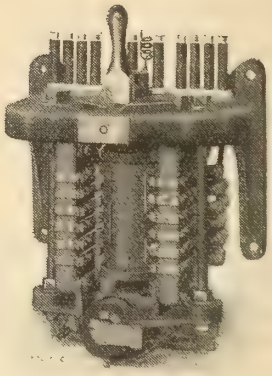
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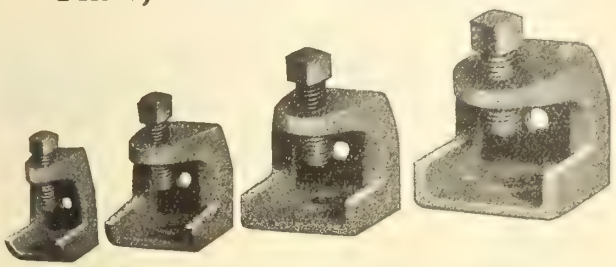
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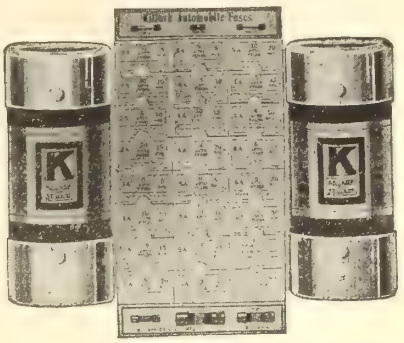
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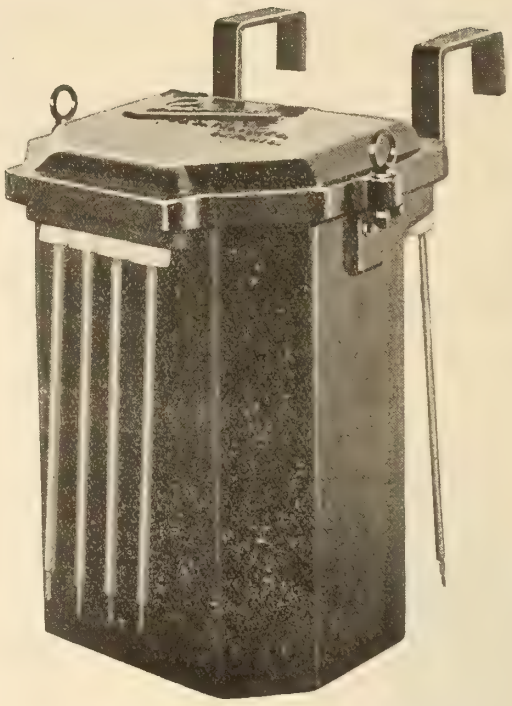
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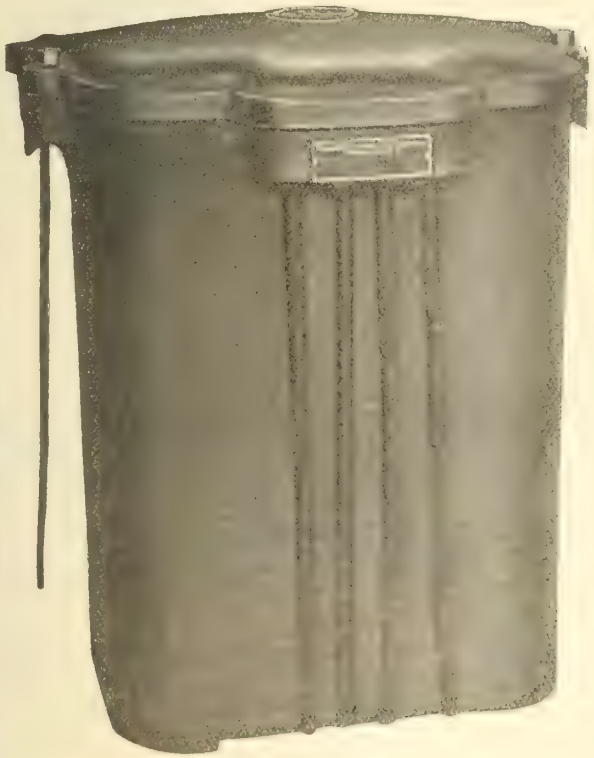
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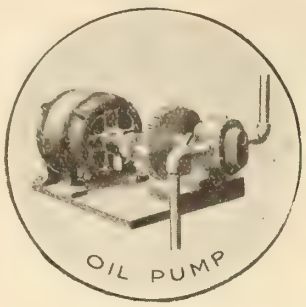
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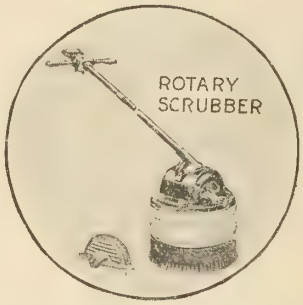
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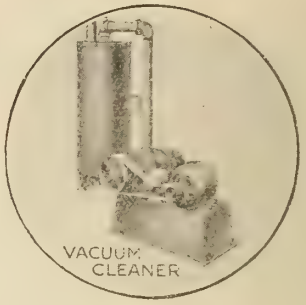
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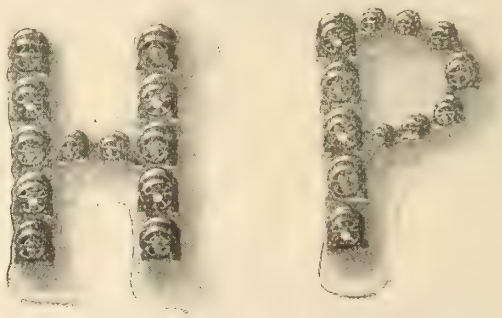






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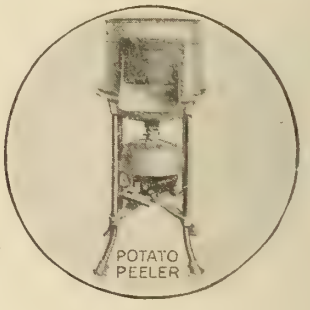
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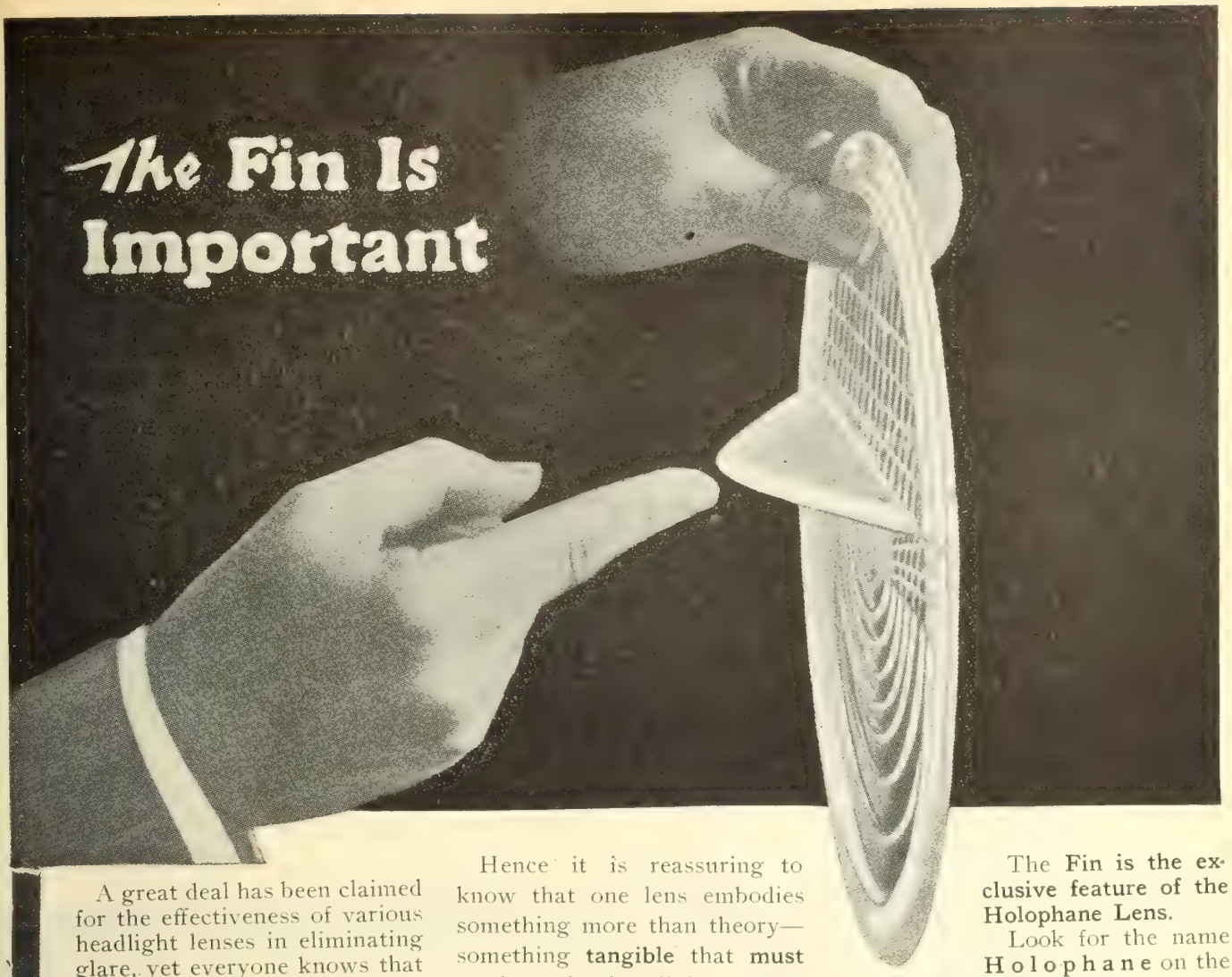






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The **Holophane Lens** is a unique product made by the acknowledged leaders of the world in scientific lighting—a lens that embodies a fin or shelf of specially treated glass, which extends backward just above the bulb of the lamp, placing a positive shield between the light and the eye of the approaching motorist.

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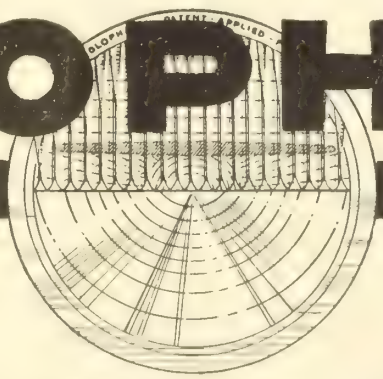
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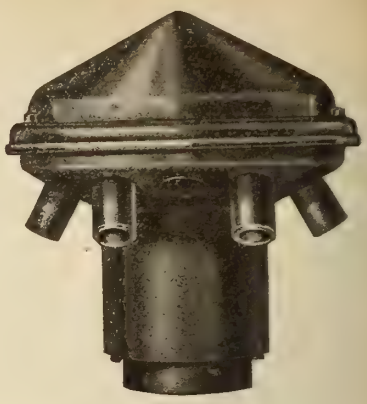
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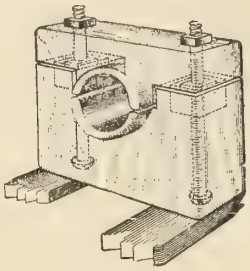
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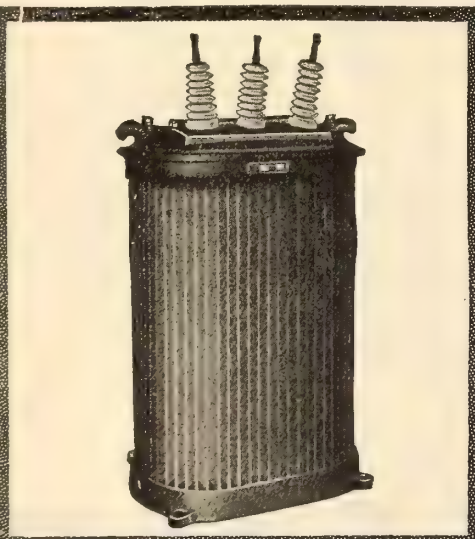
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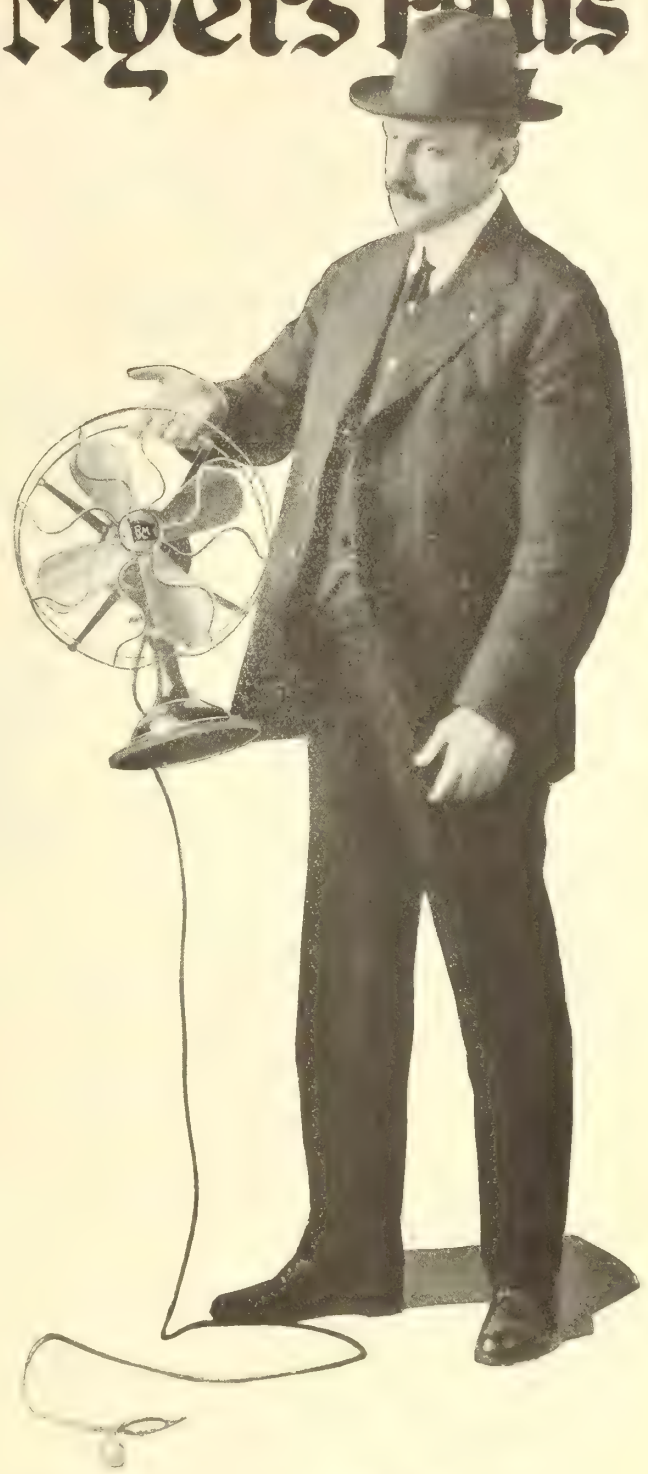
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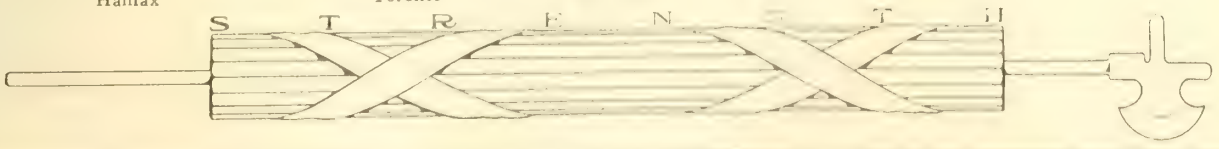
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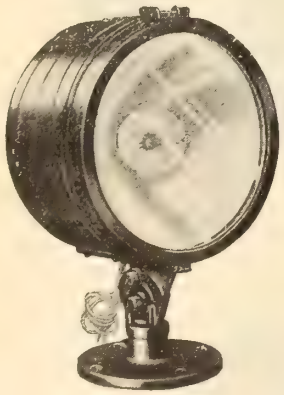
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Generation, Transmission and Application of Electricity

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Vol. 27 Toronto, April 1, 1918 No. 7

Save Coal by Eliminating Isolated Plants

As a result of the coal shortage an investigation is under way by the Public Service Commission of New York to ascertain what saving could be made, if any, by the substitution of central station service for private plants in various classes of buildings. Mr. J. W. Lieb, vice-president of the New York Edison Company, submitted data on a number of typical cases. He also estimated the total saving if the 650 odd private plants were turned over to central station service at 500,000 to 830,000 tons.

Specific Instances

Case No. 1.—An eleven-storey office and loft building plant had been closed down in the early part of 1917. Data were collected for a period of ten months and compared with the corresponding ten months of the previous year under private-plant conditions. The private plant had consumed 1,316 tons. Under central-station service for light and power there had been 541 tons consumed at the building for heating and similar purposes, and 159 tons at the central station to generate the electrical power deilvered—or a total of 700 tons. This represented a saving of 616 tons, or 47 per cent.

Case No. 2.—A five-storey and basement building. One year of private-plant operation consumed 7,237 tons. With central-station service—2,927 tons for steam heating on the premises, 1,403 tons for Edison energy supplied; total, 4,330 tons. Saving, 2,907 tons; 40 per cent.

Case No. 3.—Apartment house. The annual coal consumption, average of three years, was 2,107 tons. With central-station service the annual coal consumption for steam heating (average of two years), was 1,113 tons; for producing electrical energy supplied, 193 tons; total, 1,306 tons. Saving, 801 tons; 26.3 per cent.

Case No. 4.—An eight-storey apartment. Annual coal with private plants, 750 tons. With Edison service, 240 tons on the premises, 178 tons at the central station. Saving 332 tons; 44.5 per cent.

Case No. 5.—An apartment building. Annual coal consumption with private plant, 6,200 tons. With Edison service, 5,212 tons on the premises and at the central station. Saving, 988 tons; 15.9 per cent.

Co-operative Buying of Lamps and Appliances by Central Stations

Thirty thousand portable lamps of a standardized design are to be placed on the market next fall as the result of a recent conference in New England between a group of central-station men and a fixture manufacturer who is handling this order on an off-season basis. This co-operative buying plan includes central stations from some of the largest cities in the country, whose representatives met informally to develop the program of securing a fixture at low cost for multiple production and wide distribution. The movement promises far-reaching results in the large-scale merchandising of electrical appliances. Those behind the plan state that individualism has been overplayed in many lines of electrical selling to the general public. They believe that certain standardizations of design can be accomplished to appeal to a very wide market, and that, through the concentration of orders and through intensive production, costs can be lowered to a point which will mark a new stage in the popularization of electrical merchandise.

These central-station men recognize, of course, that no standard design of portable lamp will suit the entire market, but they believe that a large buying power exists among the public for a low-cost standard product of general application. It is believed that a great many persons will be glad to purchase a portable lamp of uniform design, wholly regardless of the fact that other people may be using the same product, provided that the price is low enough.

The matter was discussed with a certain manufacturer, and a design of portable lamp has been prepared which is expected to meet an extremely wide range of service conditions, applicable to business and home surroundings. The central-station men present represented the sales departments of their several companies, and it is noteworthy that some of the smaller cities represented were among the heaviest underwriters of the plan.

Owing to its being the dull season in fixture production, the manufacturer was willing to take the order upon a very satisfactory basis of cost. The raw material for these lamps has been purchased on a more satisfactory basis of price and delivery than applies to small and individualistic orders for scattered shipment at odd times. The manufacturer has been enabled to plan his production for steady output during the off season, and the various central stations will receive these lamps at a price, it is said, which will enable them to market them at about the former factory cost level.

Fires Due to Electricity Many Less Than Reported

It frequently has happened in the past that electrical men are amazed and, incidentally, gas men delighted, at the government reports covering the number of fires caused by electricity. For example, quoting from the Public Service Bulletins of the last few months, we have in July, 1917, 33 fires attributed to electricity defects; in August, 25; in Oc-

[illegible] 11, in November, 30; in December, 21 and in January, 1918, 32.

It is much easier to issue a report of this kind than to prove that the report is wrong, however satisfied one may feel that the evidences used in arriving at the conclusions have not been dependable. Some light was recently thrown on the situation, however, by the Toronto Inspection Department, who were naturally curious to learn why so many Toronto fires were blamed to wiring defects when very few were reported to the Inspection Department. In a recent issue of a Toronto daily paper it had been stated that defective electric wiring had been responsible for ten fires during the previous month. This matter was made the subject of enquiry by the District Inspector of the City of Toronto at the headquarters of the Chief of the Fire Department, who was responsible for the report, and the following interesting list of the ten fires attributed to defective wiring was submitted in evidence:

No. 1—Street Car No. 1318, Cor. Terauley and Louisa.

No. 2—Street Car No. 624, Cor. College and Bellevue.

No. 3—Automobile; owner, New Method Laundry; short circuit.

No. 4—Street Car No. 1298, Cor. Yonge and Cumberland.

No. 5—Street Car No. 1416, Cor. Queen and Herbert Sts.

No. 6—Street Car No. 852, Cor. Dupont and Christie.

No. 7—Street Car No. 593, Cor. Avenue Road and Bloor.

No. 8—Street Car No. 1274, Wilton and Parliament Sts.

No. 9—17 Montrose Avenue; insulation on electric wires became ignited.

No. 10—871 College Street; A. E. McCurdy; insulation on wires became ignited.

It will thus be seen that defective wiring was made to bear the brunt of ten fires which, so far as the general public is concerned, were huge conflagrations involving the loss of several hundreds of thousands of dollars, when in actual fact, they were mere blow-outs confined to individual street cars which, so far as we are aware, did not even involve running these cars in for repairs. Electricity has a perfect right to bear the blame of all the fires for which it is responsible but that insignificant occurrences of this nature should be placed in the same category with the fatalities and heavy financial losses which result from the use of gas, or from other causes, is manifestly unfair. We understand that at the present time a different classification of fires is being made in the city of Toronto so as to correct this false impression, but, so far as we know, the old methods still hold throughout the province.

Would it not be well, now that the province is pretty thoroughly covered by district inspectors, if the government should depend for their information on these inspectors instead of on fire chiefs or other men who have no knowledge of electrical matters?

Activities of Toronto Section A. I. E. E.

If nearly fifty per cent. of the local members of a society attend the meetings to hear a technical paper and twenty per cent. of these take part in the subsequent discussion it is safe to say that the society is a live and enthusiastic one and is doing good work. This is the record of the local section of the A. I. E. E. in regard to the meeting which assembled on March 15 to welcome Mr. J. J. Frank, of the General Electric Company, Pittsfield, and to hear his paper on "Modern Transformers." The paper was a most entertaining one, tracing as it did the development of this form of electric apparatus from its very earliest stage and the lecture was punctuated with a very large and well chosen series of lantern slides. It is difficult to overestimate the value to electrical engineers in Toronto of being able to discuss transformer design with a recognized expert like Mr. Frank; to debate the advantages of the different methods of cooling and oil and water circulation and the means of bringing out taps. Such papers as this are an asset to electrical engineering life in Toronto.

The next meeting of the Toronto Section is to be held at the Hydro-electric Laboratories on Strachan Avenue, on Friday, April 5, when Mr. W. P. Dobson is to read a paper on High Voltage Testing. Many of us are not sufficiently aware of the magnitude of the work undertaken by the Municipal Laboratories, and in this respect Mr. Dobson's paper, with its accompanying demonstrations, will be especially instructive.

Described Cambrai Experiences

Lieut. H. L. Phillips, of Montreal, who was in charge of a tank at the battle of Cambrai, described his experiences at the front at the meeting of the Montreal Electrical Luncheon on March 20th. He referred to the individuality of each tank, and said it was essential that the men should thoroughly understand the working of the machines; otherwise there was a great liability of a breakdown, with serious consequences. Lieut. Phillips gave details of the Cambrai battle, speaking of the initial success and the subsequent partial recovery of the ground by the Germans. Cambrai was, he said, the first battle in which the wire was cut down by tanks instead of by gun fire. Tanks were called "assaulting artillery" by the French, and they were of great value if attacking, although of little use in defensive warfare. They were proof against machine guns, but not against shell fire. Lieut. Phillips also briefly summarized the general war position, and concluded by an appeal for still greater sacrifices in order to win. If the allies did not win it meant that the children of the people in the British Empire would in a few years' time be fighting again for the same ideals as were involved in the present conflict. As one who knew from experience the worst side of war, he was convinced of the absolute necessity of a successful conclusion to the war.

Toronto Electric Club

The weekly luncheons of The Toronto Electric Club have been well patronized during the past month. Probably the best attendance of the year to date greeted Professor St. Elme de Champ on Friday, March 22, when he addressed the Club on Alsace-Lorraine. Professor de Champ spoke to combat the propaganda, at present being so assiduously carried on by the Germans, that Alsace and Lorraine are German and hold German sympathies. He quoted from legion authorities showing not only that the Germans look upon this territory as "enemy" territory, but that the people of these two countries despise and hate the Germans and submit to their rule only because they must. This evidence is further borne out by the fact that no less than 30,000 Alsatians have deserted from the German army during the present fight with the French.

Friday the 29th being a holiday, there was no meeting of the Club. On April 5 the guest will be Lieut. R. W. Harris, and on April 12, Col. Williams. Mr. H. M. Hooper, Canadian Westinghouse Company, is chairman for the month of April.

Electrically Operated Filtration Plant

The St. Hyacinthe, P.Q., civic filtration plant, now near completion, is to be electrically operated. The new De Laval pumps are to be direct connected to 3 phase, 60 cycle, 2200 volt, a.c. motors, by the Canadian Westinghouse Company. The blower for supplying air for making the filter beds, the agitators, and other equipment will be driven by electricity.

Transmission Line Practice—Some High Voltage Problems—Article IV.

By Lieut. E. T. Driver and E. V. Pannell

The rapid increase in operating voltage which has marked the transmission line art during the last decade has been dictated not only by the long distances of transmission but by the large amounts of power to be conveyed. Naturally enough the old rule of thumb of "one kilowatt per mile" was soon outclassed when energy had to be transmitted more than one hundred miles and some of the very highest voltages today are in use upon systems where this quantity amounts to less than half a kilowatt per mile. On the other hand, there exist several systems of forty or fifty miles in extent which are working at or around 100,000 volts. This permits of ample extension to the system without any change in the voltage, but the most important factor where large amounts of power are handled is the reduction in the cost of the conductors. The power to be transmitted is just as important a factor in estimating the operating voltage as is the distance; indeed, the latter is a very ambiguous expression because the power station is usually the centre of a network of transmission lines all of different lengths.

It is desired to treat more particularly of the influence of high operating voltages on the mechanical design of the line. With the advance in voltage and the consequent wider spread of conductors longer and stiffer crossarms were called for. Steel channels were adopted and later steel towers to support them and to yield the benefit arising from the longer spans and the use of two circuits on the same structure. When pressures in excess of 60,000 volts became usual the limitations of the single pin type insulator began to be felt and the suspension string was introduced. This type of insulator has several important influences on the design of the line, one of which is that since it supports the cable some 4½ feet below the crossarm, whilst the pin insulator holds

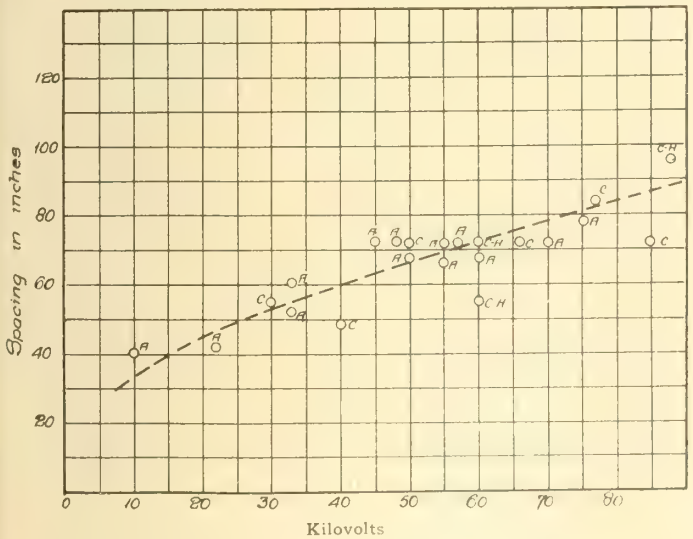


Fig. 12—Conductor spacings with pin insulators
(C denotes copper; C-H copper-hemp; A aluminium)

the conductor about 1½ feet above it, the former requires an overall height of tower about 6 feet in advance of the latter.

The spacing between the conductors is influenced by the voltage, sag of conductors and the type of insulator. Tables of standard recommendations for spacing are frequently published, but they must always be modified according to local conditions. With pin type insulators the equilateral triangle is still by far the best and most popular method of arranging the conductors, but with suspension strings this leads to a very long middle crossarm or also two cables strung on one side of the same arm. Both expedients are undesirable, and the most usual arrangement consists of the three conductors of a circuit being just slightly staggered out of the vertical plane sufficiently to avoid contact when "sleet jump" takes place. Fig. 12 shows spacings actually in use on a number of transmission systems using pin type insulators, and Fig. 13 is a similar diagram for suspension insulators. It will be noted that even for the same voltage, where the curves overlap, the spacing is considerably greater with the suspension string on account of the swinging proclivities of this form of insulator.

It is sometimes claimed that one or other conductor material requires a greater spacing than is usually adopted

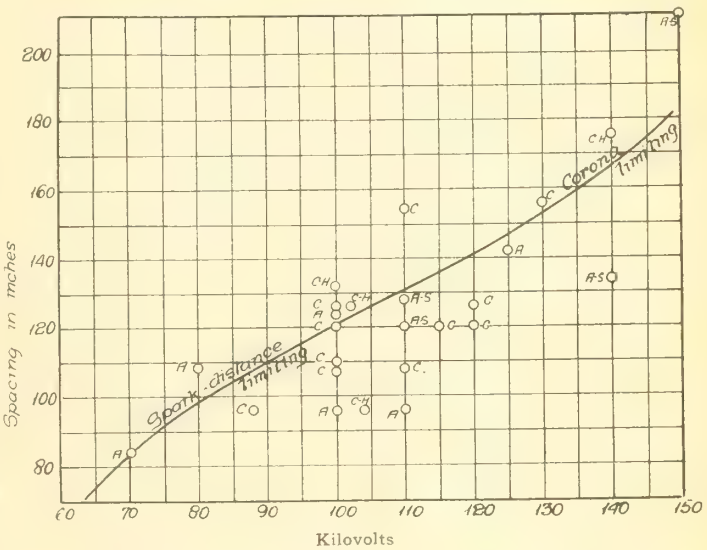


Fig. 13—Conductor spacings with suspension insulators
(C denotes copper; C-H copper-hemp; A aluminium; A-S aluminium-steel)

and hence involves more costly construction. In these two figures the kind of conductor employed has been indicated, and it will be seen that there is really no rule for spacing aluminium wider than copper or aluminium-steel closer than copper. Local wind, ice and temperature conditions are the most important factors. There is no very great diversity in the matter of spans and sags among the points plotted on these diagrams, probably the average conditions of 600 foot span and 25 foot sag govern the generality of them.

Whilst the spacing of the wires up to voltages of about 80,000 is governed by sparking distance under abnormal conditions which would swing the conductors close together, a different phenomenon controls the spacing as the pressure is increased above this limit. This is the factor of corona. Our present knowledge of corona losses is based very largely upon the investigations made by Mr. F. W. Peek, of Pittsfield, Mass., and published in the A.I.E.E. Transactions during the last eight years. The fact that at a certain potential gradient around any conductor the air breaks down as an insulator has long been known, but it has remained for Mr. Peek to codify this law so as to render it easily calculable for transmission line work. Briefly stated, at a certain definite critical voltage, corona will appear. It will increase very

[illegible] with any rise in the voltage beyond this point. The value of the critical voltage (e_0) is

$e_0 = 2.302 \times m_0 \times g_0 \times r \log_{10} d/r \times \lambda$

where m_0 = irregularity factor varying from 1.00 for a clean solid wire down to .083 for a seven strand cable.

g_0 = breakdown potential gradient of air, 53.6 kilovolts per inch.

r = radius of conductor, inches.

d = mean spacing of conductors, inches.

e_0 = critical pressure in kilovolts.

λ = air density.

It will be interesting to calculate the critical voltage for

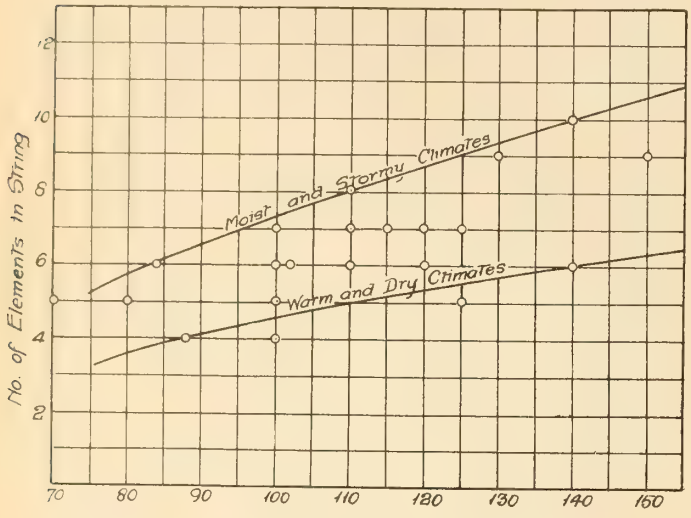


Fig. 14—Number of elements used in suspension insulator

a typical transmission line operating at 110 kilovolts with seven strand 0 B&S cables spaced 96 ins. apart. The radius of this cable is .188 ins., and assuming λ as unity:

$e_0 = 2.302 \times .83 \times 53.6 \times .188 \times \log 96/.188.$

$= 52$ kilovolts.

This is, of course, the critical voltage measured to neutral, and in order to compare it with the line voltage the latter must be reduced to the same terms by dividing by $\sqrt{3}$. This gives the operating voltage to neutral, as 63.5 kilovolts an excess of 11.5 kilovolts over the critical pressure. High altitude or stormy weather will reduce the factor λ and so decrease the critical voltage still further. Now the losses which arise from the corona discharge are given by the equation

$$P = \frac{k'}{\lambda} \times \frac{f}{10^5} \times (e - e_0)^2 \sqrt{\frac{r}{d}}$$

where k' = constant = 552.

f = frequency.

e = operating kilovolts to neutral.

It is important to note that the losses increase as the square of the difference between the critical and operating voltages. They are also greater with higher frequencies and are less for liberally spaced conductors. Assuming a frequency of 60 cycles and following the foregoing example:

$$P = \frac{552 \times 60 \times .0445 \times 11.5 \times 11.5}{10^5}$$

$= 1.93$ kilowatts per mile of wire.

Under working conditions there will probably be two three-phase circuits so that the total loss per mile of line will amount to $6 \times 1.93 = 11.6$ kilowatts. It must be emphasized that the above calculations for a typical example yield only the fair weather loss and that any atmospheric disturbance would lower the barometer and result in a lower critical voltage and increased losses.

As a matter of actual fact it is, of course, incorrect to assume the same voltage over the whole line, and since the corona discharge is determined by the difference between the critical and the operating voltage at any point it is the most satisfactory method of calculation to divide the line up into sections assuming the operating voltage (e) to be uniform over a whole section.

It is not a difficult or an expensive matter to design a line of the highest operating voltage which shall be free from corona troubles. Liberal spacing and large size conductors are the necessary factors in the elimination of the losses. It was shown in an earlier article in this series that copper yields the smallest of a group of conductor materials, all of which have otherwise good characteristics. It is here found that the very factor which is somewhat of a drawback to the use of aluminium, copper-clad-steel, or aluminium-steel, namely, the larger diameter, is a valuable advantage for working at very high voltages on account of the relative freedom from corona. Aluminium or aluminium-steel cables have respectively 28 and 43 per cent. greater radii than the equivalent copper with a consequently higher critical voltage.

In Fig. 15 are shown the highest voltages for which a system can be designed without corona being in evidence under fair weather conditions. From this it will be seen that there is relatively little difficulty in transmitting with cables of 4/0 B&S or larger, but with smaller sizes of conductor it becomes next to impossible to avoid corona without extra wide spacings. The remedy lies in the sale and transmission

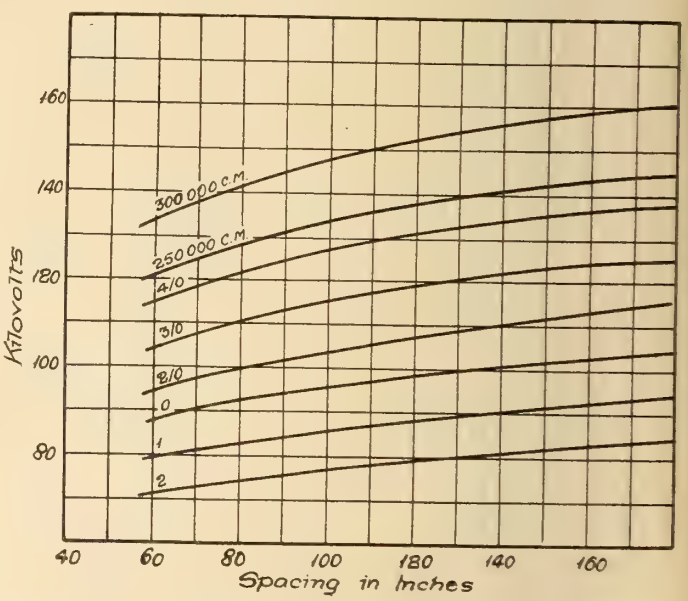


Fig. 15—These curves show the maximum operating voltage which will not yield corona in fair weather

of still greater amounts of energy so that cables of at least 4/0 B&S can be economically loaded and used.

Regarding actual experiences with corona there have been few practical tests made under working conditions. These losses are included with other stray power losses throughout the transmission line so that it is difficult to assign the correct value to the corona. As a matter of fact, wherever corona has made its appearance and been measured, it has never been found to be less than the calculated value. On the lines of the Central Colorado Transmission system the altitude averages 8,000 feet and the phenomenon is met with. The cables are of 0 B&S copper, seven strand with a hemp core, and the critical voltage for this altitude and conductor size is very nearly 100,000 kilovolts, which is also the operating voltage. It is also claimed that the radio-active properties of the pitchblende which occurs in the district, are responsible for a partial ionization of the air, thus indirectly reducing the critical voltage.

On the Au Sable Company's transmission lines in Eastern

Michigan corona is also experienced; the operating pressure is 140 kilovolts and the cables are seven-strand 0 B&S copper with a hemp core. In a report on this line it is stated: "Experience at Au Sable proves that transmission at 140,000 volts is an economical procedure but it should be made clear that such a pressure is justified only where the distance and the quantity of power to be transmitted are such that conductors of sufficient section to prevent corona are economically used. While it has been suggested that hemp centre cables might provide increased cylindrical areas and so raise the corona limit, the fact remains, according to the experience of the Au Sable Electric Company's engineers, that such hemp centre cables show a greater corona loss than equivalent all copper conductors."

Joint Committee of Technical Organizations

Holds Annual Meeting—Chairman Alfred Burton Reviews Year's Activities Before Large Attendance

To the Technical Men of the Province of Ontario:

Gentlemen: Your committee has pleasure in submitting its second annual report, covering activities during the period elapsed since our first annual meeting in March, 1917. Meetings of the joint committee have been held monthly during the year to hear reports from the executive, deliberate on questions of policy, and appoint and instruct sub-committees. The executive committee have held about 40 meetings.

Finances

Up to September, 1917, the expenses of the joint committee were carried entirely by private subscription. Since that date, largely owing to the generous recognition of services rendered to the Imperial Munitions Board, we have had less difficulty in defraying our running expenses. The chief items consist of the rental of a small office, the salary of a stenographer, and the cost of printing, postage, etc.

Changes in By-Laws

A slight alteration has been made in the wording of our by-laws so that the committee now includes a representative from the Canadian Manufacturers' Association.

This was deemed highly desirable on account of the close relationship existing at the present time between the technical and industrial activities of our country. The wisdom of this addition has been amply justified in the valuable assistance the representative of that association has rendered your committee.

Inventions

One of the most important activities of your committee, and one which we are pleased to feel has been of real assistance to the Imperial Munitions Board, has been the study of the various and varied inventions submitted to that board from all over the continent. These inventions, in the main, have reference to war activities, such as improvements in aeroplane design, detection of submarines, etc. Some idea of the amount of work entailed may be gained from the fact that detailed reports have been made to the Imperial Munitions Board during the past year on almost 100 inventions. This work has been handled through the medium of a special sub-committee, whose work is deserving of a very grateful and special mention.

Aviation

A sub-committee has been formed for the study of aeronautical problems. The work of this committee, which is of recent creation, has consisted to date in compiling information, and, in general, getting in touch with the various phases of the work through correspondence and personal interviews. It may be too much to expect that this committee will be enabled to carry out any experiment which will have any direct bearing on maintaining the supremacy of the Allies in France, but such a group of men, with intimate knowledge of the subject of aeronautics, will be an invaluable asset to Canada in the future development of aeroplanes, for which there is certain to be an increasing demand, quite independent of the duration of the war.

Depletion of Civil Ranks of Engineers

A survey of the engineering departments of our Canadian universities has demonstrated, during the past few months, that, due to war demands, the ranks of engineers are being depleted much faster than they are being recruited from the universities. As an instance, it may be mentioned that in one of our universities the present attendance in the science department is only about 15 per cent. of what it was in 1914. This state of affairs will not only be fatal to the proper prosecution of the war if it should last much longer, but it will leave us unprepared to take our part in the great engineering construction activities that must follow the cessation of hostilities.

Having this in view, your committee has considered ways and means of increasing the attendance in the engineering faculties, and in the very near future will have a definite, concrete proposition to offer. It will probably involve the expenditure of a few hundred dollars per year. How this money can be raised has not yet been determined, but, if not otherwise available, we have every confidence that the technical men of the province can be depended upon to supply the necessary funds for a cause so urgent at this moment and so much in line with our natural sympathies.

Technical Men Being Used Inefficiently

A phase of the technical situation having a direct bearing on the last item is the inefficient use that has been made of trained technical men in the past by placing them in the infantry ranks or in other war work where unskilled men would have been almost equally effective. When the present Military Service Act came into force your committee again took occasion to call the attention of the proper government authorities to this waste and to urge that engineers in future be utilized in such work as their special training best fitted them to perform.

Catalogue of Technical Books

Your committee has discussed the probable value to the average technical men of a catalogue of all the technical books to be found in the various libraries, both public and private, in Toronto and possibly including libraries in other cities. Such a catalogue exists with regard to magazines, but there is nothing of this nature covering books. The matter, as most of us are aware, has been the subject of discussion in all the various technical organizations which have representation on this committee, and has met with their approval in every case. It remains now to determine the best means of accomplishing the desired end with such assistance as we

Questionnaires

by your committee for the Advisory Council for Industrial

Research, and which was under way at our last annual meeting, has been completed. Assistance has also been given with questionnaire No. 4 to the extent of supplying the Advisory Council with our list of Ontario's technical men and in other minor matters. Your committee also assisted in the preparation of a questionnaire recently submitted by the Canadian Manufacturers' Association to their members re power shortage.

Training the Blind for Mechanical Work

It is inevitable that many of our brave fellows will return to Canada, during and after the war, afflicted with total blindness. A foretaste of this problem was seen in the recent Halifax disaster, in which so many lost their sight. It is, of course, common knowledge that in Great Britain very considerable progress has been made in training the totally blind to do mechanical work, and some progress has been made in the United States in the same direction, more notably in winding standard coils. Your committee is gathering all available information on this subject, so that it may be ready to pass along to the proper authorities. It is not entirely apparent how the practices of Great Britain and the United States can be followed or developed in Canada, where the amount of purely repetition work, such as coil winding, mentioned above, is comparatively small, but we believe the question is well worth further study.

Lists

Our original lists of technical men have been kept up to date as far as is humanly possible, and, at the present time, are undergoing a complete revision and verification. These lists have proven of the greatest value on numerous occasions, for, although it is understood that they are kept strictly confidential, we have nevertheless been able to compile from them from time to time smaller special lists for different government and war activities which, we feel quite satisfied, have repaid us all for any trouble we may have been put to in their preparation.

Vocational Training

During the early part of the year your committee was actively interested in the matter of vocational training of returned wounded soldiers, and it is with some feeling of pride that we report the selection of a member of your committee as the administrator for Canada of the vocational branch of the Military Hospitals Commission, now the Invalided Soldiers Commission. I am pleased to note that the administrator himself is with us this evening, and, as your program has already announced, will tell us of the work being done under his able organization.

Other Activities

At the time of the Halifax disaster your committee, cooperating with the Toronto Chapter of the Ontario Association of Architects, made offers of assistance in an advisory capacity to both the Commission of Conservation, Ottawa, and to the Halifax Relief Commission, Halifax. On account of the almost complete destruction of certain parts of the city it was felt there might be opportunity to rebuild at least a portion of the devastated area along predetermined lines, so as to produce something in the nature of a model city. Another matter in which we have lent our assistance is recruiting for the Canadian Engineers. I may say, also, that we have been entrusted with certain other work, about which it would not be wise to make public mention at the present time.

In Conclusion

In conclusion, I should like to add my word of appreciation of the work of the members of the joint committee, every one of whom has given freely of his time, ability and experience in the earnest hope that our little endeavor to lighten the load under which the Empire labors may not be fruitless. In this hope—that we have helped, even ever so little, to bear this burden—lies the recompense dearest to the heart of every true engineer.

Cost of Mailing vs. Hand Delivery

Majority of Central Stations Adopting the Latter Practice Since Postal Rates Increased

With the more recent increase in postage in the United States, central station companies in that country, as previously in Canada, have had to revise their methods of bill delivery. When a notice could be sent for one cent and labor was scarce and independent, the mail was usually considered more economical. Doubling the cost of postage entirely changes the complexion of matters, however, and we find that hand delivery is now being very commonly resorted to. An article in a recent issue of the Electrical World describes the policies of a number of prominent central station companies:

Not long ago—but before the postal rates went up—the Cleveland Electric Illuminating Company made an analysis of the cost of its bill delivery, which includes 60,000 bills delivered by hand and 40,000 by mail, to find out how much could be saved by using a post-card bill. The figures were found to be as shown in the acompanying table.

With the 1-cent postage rate the post-card proved to be the cheaper method, but the doubling of this cost made the hand-delivery system far more economical. The system in Cleveland has been to place the delivered bill in the consumer's mail box, or, if there is no box, to hand it to a member of the family. Failing this, the distributor brings back the bill and it is mailed. For this delivery the Cleveland company first tried boys 16 or 18 years old, but did not find them satisfactory. It then employed elderly men of from 50 to 65 years, and has practically eliminated all complaints.

In Sandusky, Ohio, however, the Sandusky Gas and Electric Company has had most satisfactory results from high school boys, who both read the meters and deliver the bills. The boys receive 1 cent per meter read. Before the postal rate went up the company used government post-cards, but since then it has devised a card of the same size, of which a six months' supply can be printed in advance. These are stamped and mailed to customers beyond the convenient reach of the delivery routes, but the bulk of them the boys deliver at a cost so far of approximately a half-cent per bill. This the company find is effecting a saving of $18 per 1,000 customers per month on postage alone, and is bringing additional economy by reducing the operating force to a minimum during the winter. Because of the limited number of hours that the students have available for this work, it is necessary to employ a much larger number than if the regular employees were handling it, but this has not proved an objection. About 9,000 bills are delivered in Sandusky between the twentieth and the last of each month.

In Mobile, Ala., the company now delivers by hand, at a cost of about 1½ cents per bill, a saving of about $37.50 a

month since the postal increase. In Traverse City, Mich., the company delivers to about 1,400 consumers, at a cost of 1 cent, and this also includes collecting about one-third of the accounts. In Pine Bluff, Ark., the company delivers 4,500 bills, using the regular meter readers after the readings are completed. It requires from four to five days, and costs in all, it is figured, from $10.50 to $12.50. In Kokomo, Ind., the company has also changed from mailing to delivery, and is distributing 6,000 bills by meter readers, at a cost of $35. In Kingston, N.Y., the meter readers now deliver 5,800 gas and electric bills, all except about 300 which are mailed to outlying territory, and the company finds the system quite as dependable as by mail. It saves approximately $50 every month. In Indianapolis the meter men of the Merchants' Heat and Light Company read meters every morning and deliver bills in the afternoon, and they have proved much more responsible than schoolboys, though boys were tried. The cost per bill now figures about 1 cent. In Denver the bills are mailed to the suburbs, but delivered in the city by boys and young men on bicycles, at a cost of one-third of a cent per bill.

In Wilkes-Barre, Pa., 19,500 bills—gas, electric, and steam heat—are delivered by two men, who receive $65 per month, delivering continuously, which means a cost of about one-half cent per bill. These men collect when possible as they deliver. In Terre Haute, Ind., the company formerly had mailed all bills at a total cost of $125 monthly, but with the higher postal rate began delivering all bills within the city by one man, who is paid $45. The remaining postage cost for bills still mailed is also $45, so that, in spite of higher postage, the company is saving $35 monthly.

On the other hand, in many outlying towns in Indiana the Indiana Railways and Light Company began with this year to try the plan of not sending any bills at all to some 2,000 customers, who are asked to call at the local offices to pay their bills, though delinquency notices are still mailed when necessary. In line with this, in Brattleboro, Vt., in Franklin, Ind., and in Seymour, Ind., the local utilities have been furnishing many customers with cards on which to make their own meter readings. This method has met with considerable success. In Fort Madison, Iowa, the meter reader in certain residence districts carries with him bills already partly made out, on which he enters the reading, making out the bill and presenting it for collection at the one call. The company's other bills go out on post-cards, and, in short, since the rates went up there has been a decided movement in the industry toward the post-card bill as offering an appropriate war-time economy.

Few Companies Using Women

All in all, however, the trend is toward delivery, if not by meter reader, then by boys or old men. One New England central station has found a practical solution by making use of the services of the substitute postmen, who, though on waiting orders, are familiar with the town and have received instructions in delivering. Everywhere the possible expedient of utilizing women for delivering has been considered, but apparently it has not been adopted very largely. However, El Reno, Okla., reports the bill delivery in charge of two young women, who are taking care of it well, and at a saving of $30 monthly on postage. At Binghamton, N.Y., girls are used to read meters and deliver bills.

Of course, the many cities where bills have always been mailed at the 2-cent rate are not affected by the postal increase. Buffalo and Wilmington, Del., state that they have no intention of changing, for they consider mailing less trouble and more sure. In Detroit, on the other hand, the company has been delivering bills by messenger for years, at a cost much less than postage, the meter readers delivering the bills. In Providence, R.I., the method is optional with the consumer in most districts. He may have it by mail or messenger, as he prefers, and bills for suburban towns are delivered to the suburban post-offices and mailed there under the local rate.

Comparison of Cost of Handling 100,000 Consumers' Bills Per Month With Special Card or Government 1-Cent Post-Card System.

Present system, printed bill in outlook envelope; 60,000 delivered by company distributors, 40,000 mailed with 2-cent stamps.

Present system:		
100,000 bills at $1.50 per 1,000	$150.00	
100,000 outlook envelopes, at $1.65 per 1,000	165.00	
40,000 2-cent stamps in rolls	802.40	
Enclosing bills in envelopes—2 boys one month at $40 each	80.00	
Sealing 100,000 envelopes and affixing 40,000 stamps, one boy one month	15.00	
*Sorting 60,000 bills for delivery, one boy one month	40.00	
*Delivering 60,000 bills, five men at $70 per month	350.00	
Supervising delivery, half time of one man at $100	50.00	
Total		$1,682.40
Proposed system:		
Special cards, 1-cent post stamp affixed:		
100,000 cards printed	$116.00	
Affixing stamps, one boy one month	45.00	
100,000 1-cent stamps, in rolls	1,006.00	
Total		1,167.00
Amount saved by using special cards and affixing stamps		$515.40
Government 1-cent post-cards:		
100,000 cards	$1,000.00	
Printing	25.84	
Total	$1,025.84	
Additional saving with government cards		141.16
Amount saved by using government stamped cards		$656.56

*Items checked indicate expense of delivering 60,000 bills per month. To find total delivery expense on 100,000 bills, add item No. 3, 40,000 2-cent stamps, $802.40.



Mr. E. H. Porte, General Manager The Renfrew Electric Manufacturing Co., Ltd., Renfrew, Ont., makers of "Canadian Beauty" household appliances. Mr. Porte leaves the Ontario Hydro-electric Commission after seven years' progressive service

Latest Information on Incandescent Lamps

By H. W. Mateer*

Mazda B lamps operate equally well in all positions. Data on the burning positions of Mazda C lamps are given in Table 1. It will be noticed from the table that Mazda C and Mazda C-2 lamps in sizes larger than 150 watts are not regularly supplied to burn in positions other than the vertical, tip down. While it is possible to modify the construction of the larger size lamps so that they will operate fairly well in positions other than tip downward, in practically all cases it will be advisable to modify the auxiliary equipment so that regular lamps may be utilized.

Color Quality of Light

The color quality of the light from a clear bulb incandescent lamp depends primarily upon the temperature of the filament. As the temperature increases, the light becomes of a whiter quality. At the temperature at which the filament of the Mazda B lamp is operated, the light has an excess of red and yellow rays when compared with average natural daylight. This characteristic has been present throughout the centuries in which lighting sources have evolved from the torch to the incandescent electric lamp. The influence on this characteristic is manifest in the red, brown, and amber tones which predominate in the decorations of rooms designed to appear at their best under artificial light. That a light of this quality is essential to the prevailing color schemes is evidenced by the frequent choice of amber colored shades. On the other hand, an artificial illuminant whose color quality is approximately the same as natural daylight is welcomed by many as opening new possibilities in interior decoration design.

The Mazda C-2 lamp has the proper screening properties incorporated in the glass of the bulb. The excess of red and yellow rays of the light are absorbed while the blue and green rays are permitted to pass through, thus a light of afternoon sunlight quality is produced at an efficiency about equal to that of the Mazda B lamp. While the color

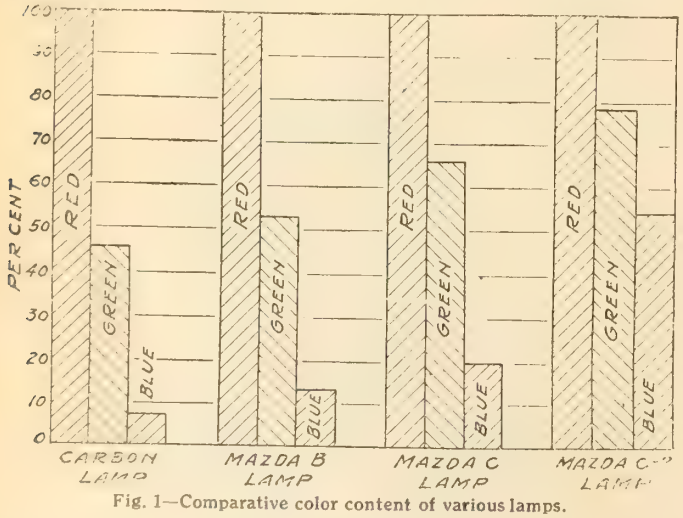


Fig. 1—Comparative color content of various lamps.

quality of such a light is sufficiently near that of daylight to serve for general illumination, and from this standpoint is a decided improvement over the light emitted by the uncolored bulb lamps, it is not of the proper quality to permit extremely accurate color matching. Where an accurate duplication of north sky light is necessary, units employing Mazda C lamps and properly designed color-screen plates should be used. The light from such units is of constant quality and therefore more dependable than the natural north sky light, which varies in quality from day to day.

The diagrams in Fig. 1 show a comparison in primary color content of the light of carbon, Mazda B, Mazda C and Mazda C-2 lamps. It will be seen that a very decided improvement in the color quality of artificial light has been effected from the time the carbon lamp was used up to the present.

Mazda B Lamps

Mazda B lamps are listed in Table 2. They are supplied in either straight-side or round bulbs for voltages of 110 to 125, and 220 to 250 volts, as indicated in the table. The efficiency ranges from 7.5 lumens per watt for the 10-watt lamp to 10.6 for the 100-watt round-bulb lamp. In practically all cases lamps should be equipped with scientifically designed reflectors, since in this way the light distribution can be controlled, and a largely increased proportion of the light be directed to the surfaces where it is desired. In all cases where the filaments are likely to be within the normal visual field, bowl-frosted lamps should be used.

Mazda C Lamps

Table 3 lists the Mazda C lamps which are designed for ordinary multiple operation. The efficiencies range from 11.5 lumens per watt for the 75-watt 110-125 volt lamp to approximately 18 lumens per watt for the 1,000-watt lamp of the same voltage class.

The filaments of all Mazda C lamps are intensely bright, and where it is at all likely that they will come within the line of vision, they should be screened from the eye. However, up to and including the 200-watt size, lamps may be used satisfactorily in open reflectors provided they are bowl-frosted. In the lighting of stores, offices and public buildings, except where semi-indirect or totally indirect lighting is employed, lamps of larger size than the 200-watt should be equipped with enclosing globes of sufficient area and of proper density to avoid the usual objectionable glare.

Mazda C-2 Lamps

Mazda C-2 lamps, as previously mentioned, employ the blue-green bulb of carefully colored glass, and are designed for general illumination where approximate daylight color quality is desired. The screening properties of the bulb are such that part of the red and yellow rays of the light from the filament are absorbed and thus the color quality of the transmitted light is that of afternoon sunlight. Obviously, the total light production is somewhat decreased by the absorption of the colored bulb. In spite of this, Mazda C-2 lamps operate with efficiencies about equal to those of Mazda B lamps. When replacing Mazda C lamps with Mazda C-2 lamps, it is necessary simply to use 50 per cent. more wattage to obtain the equivalent intensity.

Mazda C-2 lamps are furnished in sizes from 75 watts to 500 watts for voltages of 110 to 125. Additional technical data are given in Table 4.

Effect of Improvements

Since Mazda lamps were first manufactured, each new development has been accompanied by an improvement in lamp quality. Some improvements cannot be seen by the eye, others are noticeable as marked changes in construction, but all are manifest in the improved service rendered. Although improvements are continually being made, consideration is always given to making them in such a way that their advantages may be realized without the scrapping of existing equipment.

*Engineering Department, National Lamp Works of General Electric

Table No. 1—Burning Positions for Mazda C and Mazda C-2 Multiple Lamps

Lamps	For Tip Down Burning*	For Tip Up Burning	For Horizontal Burning
75-watt 100-watt 150-watt	110-125 volt	Lamps regularly supplied will burn in any position.	Lamps regularly supplied will burn in any position.
200-watt	110-125 volt 220-250 volt	Lamps regularly supplied are designed to burn in this position.	Lamps of special design furnished on special orders.
300-watt 400-watt 500-watt 750-watt 1000-watt	110-125 volt 220-250 volt	Lamps regularly supplied are designed to burn in this position.	Lamps of special design will be furnished on special orders.

Municipal Electrical Engineers Organize

Form Association Composed of Managers, Superintendents and Engineers of Ontario's Publicly Owned Utilities

The Engineering Section of the Ontario Municipal Electrical Association met in convention on March 13-14 in the Chemistry and Mining Building of the University of Toronto and, after a free discussion, decided to form a separate association. This decision took the form of a resolution, moved



Mr. E. V. Buchanan, London, President

by Mr. P. B. Yates, St. Catharines, and seconded by Mr. O. N. Perry, Windsor, which read as follows:

Form of Resolution

"That since we have been unable to effect a proper organization of Municipalities to consider operation and engineering questions of policy through the formation of the association originally laid down as an engineering branch of the Ontario Municipal Electrical Association, be it resolved that we recommend the establishment of an association of the managers, superintendents and engineers of the different Municipal Electrical Utilities free from the Ontario Municipal Electrical Association and financially independent."

The Convention then proceeded to draft a Constitution and By-laws which were considered clause by clause and adopted after discussion. The main features of the by-laws are printed below. As provided for in these by-laws, the officers are president, vice-president, secretary-treasurer and chairmen of standing committees. The elected officers for the coming year are as follows:

Officers

President, E. V. Buchanan, London, Ont.

Vice-President, E. I. Sifton, Hamilton, Ont.

Secretary, S. R. A. Clement, Hydro-electric Power Commission, Toronto, Ont.

Treasurer, R. C. McCollum, Hydro-electric Power Commission, Toronto, Ont.

Membership and Credentials Committee:—Oswald F. Scott, Belleville, Chairman; P. B. Yates, St. Catharines; J. J. Heeg, Guelph; W. E. Reesor, Lindsay; E. H. Caughell, St. Thomas.

Papers Committee:—V. S. McIntyre, Kitchener, Chairman; H. H. Couzens, Toronto; H. D. Rothwell, North Bay; F. F. Espenschied, Hydro-electric Power Commission, Toronto; L. G. Ireland, Hydro-electric Power Commission, Toronto.

Conventions Committee:—E. J. Stapleton, Collingwood, Chairman; J. E. B. Phelps, Sarnia; A. T. Hicks, Oshawa; J. McLinden, Owen Sound; O. N. Perry, Windsor.

Rules and Regulations Committee:—R. H. Martindale, Sudbury, Chairman; J. G. Archibald, Woodstock; V. B. Coleman, Port Hope; H. O. Fisk, Peterborough; T. C. James, Hydro-electric Power Commission, Toronto.

CONSTITUTION

This organization shall be known as the Association of Municipal Electrical Engineers (of Ontario), and it is organized for the following purposes, to wit:

1. To further the interests of Municipal Electrical Utili-



Mr. E. I. Sifton, Hamilton, Vice-President



Mr. S. R. A. Clement, Toronto, Secretary



Mr. R. C. McCollum, Toronto, Treasurer



Mr. R. H. Martindale, Sudbury,
Chairman Rules and Regulations Committee



Mr. V. S. McIntyre, Kitchener,
Chairman Papers Committee



Mr. E. J. Stapleton, Collingwood,
Chairman Conventions Committee

ties in Ontario and to foster closer co-operation between the Municipalities and with the parent organizations, viz.: The Hydro-electric Power Commission of Ontario and the Ontario Municipal Electrical Association.

2. For the mutual assistance of its members, education along technical and commercial lines, and the standardization of methods, apparatus and materials.

BY-LAWS

Membership

Membership in the Association shall be open to Ontario Municipal Electrical Utilities, operated locally or by the Hydro-electric Power Commission of Ontario. Each Member Utility is entitled to representation by delegates of the following active classes: Class "A," Class "B." A Class "A" delegate shall be the chief operating executive or other authorized representative of any Ontario Municipal Electrical Utility or Local Electrical Utility operated by the Hydro-electric Power Commission of Ontario, and only one such delegate from each Municipality will be permitted. The Ontario Municipal Electrical Association shall have the privilege of holding two Class "A" memberships. A Class "B" delegate shall be any other commissioner, official or employee of any Ontario Municipal Electrical Utility.

Associate Membership

Persons not eligible for either of the former two classes may be elected as Associates by a two-thirds majority vote of the Class "A" delegates present at any general meeting of the Association.

Privileges

Class "A" delegates shall be eligible for any office in the Association, and shall hold the only voting rights. The presiding officer at any meeting shall vote as a delegate, and in case of a tie shall also have the deciding vote. Class "B" delegates shall be eligible for any office in the Association other than President and Vice-president. Associates shall be eligible for any office in the Association, excepting President, Vice-President, and Chairmanship of standing committees. In all other respects the entire membership shall enjoy equal privileges, one class with another.

Officers

The officers of the Association shall be President, Vice-President, Secretary, Treasurer and Chairman of the Standing Committees. They shall each hold office, after being duly elected, for one calendar year, or until their successors are chosen, unless suspended for cause by a two-thirds majority vote of the Class "A" delegates present at any general meeting of the Association.

Meetings

Meetings shall be held from time to time; but not less than twice each calendar year, the month and place of meeting having been selected by the Association at a prior meeting. A quorum for the purpose of transacting business shall consist of a majority of the officers, and in addition Class



Mr. Oswald F. Scott, Belleville,
Chairman Membership and Credentials Committee

"A" delegates from not less than twenty per cent. of the Member Utilities. Motions shall be passed by the majority vote of all Class "A" delegates present at a legal meeting. Special meetings for specific purposes may be held at any time and place on the call of the President or on the written demand of at least 10 per cent. of the Member Utilities.

Standing Committees

The standing committees of the Association shall be as follows:—1. Membership and Credentials Committee; 2. Pa-

(Continued on page 35.)

Electric Railways

Fast Service Line Niagara Falls to Buffalo—Operation at 600 Volts—Cost Approximates $170,000 per Mile

An article in Electric Traction by H. E. Riexinger, Chief Engineer, International Railway Company, describes a line this company is building, designed for high speed operation, between Niagara Falls and Buffalo, a distance of some twenty-three miles. The line will be operated at 600 volts, d.c. Other details are given as follows:

Overhead Construction

The overhead is of the catenary type. The messenger is 500,000 c.m. hard drawn copper cable having a 3-ft. sag between supports, spaced 200 ft. apart. The 4/0 hard drawn trolley wire having a voltage of 600 is attached to the messenger at 10 ft. spaces.

The supports for the overhead consist of steel bents and trusses spaced 200 ft. apart on tangents and varying down to 90 ft.

Four different types of steel catenary bridges have been adopted, one for use on tangents, a second for curves, a third type for strain towers, and a fourth for dead end towers at each end of the line. These catenary bridges are of unusually heavy design because of the probability of constructing additional transmission lines above this entire structure.

In all there are 420 of these catenary bridges, containing over 800 tons of structural steel.

Sub-stations

To take care of the power supply one new sub-station was built at Niagara Falls, and the existing sub-stations at Paynes Avenue and at Fillmore Avenue were changed so as to meet the demands of the new line.

At the Paynes Avenue sub-station, three 400-kw., rotary converters were taken out to provide room for three 1,000-kw. machines. The transformers, bus bar and switchboard equipment were changed to meet requirements.

At the Fillmore Avenue sub-station, one 400-kw., rotary converter was removed, and one 2,000-kw., rotary converter was installed.

The new sub-station at Niagara Falls has two new 1,000-kw. General Electric rotary converters, and three 400-kw. rotary converters were taken from the present Niagara Falls station. Oil-cooled transformers were used instead of air-cooled because it was thought that the close proximity of the large chemical plants would make the use of air-cooled apparatus unsatisfactory.

While plans were being drawn it was not known definitely just what the incoming voltage would be at the Niagara Falls sub-station. It was finally decided to use 11,000-volt energy, but if it becomes desirable in the future to use 22,000-volt it will not be a serious problem.

The 11,000-volt equipment selected can be utilized for 22,000-volt with slight changes, the power transformers being wound for either voltage. The 35,000-volt H-3 type oil switch, double ratio current transformers, disconnect switches and bus bar material are all suitable for either voltage. If it becomes advisable to discontinue the use of 11,000-volt energy and use 22,000-volt, it will be necessary to change the connections in the power transformers and current transformers, to purchase two 22,000-110-volt potential transformers for instruments on the switchboard, and to change slightly the method of entering the building.

The actual expenditures involved by the construction of the Buffalo-Niagara Falls line will be about as follows:

Right-of-way	$ 850,000
Bridges, trestles and culverts	605,000
Sub-station equipment	111,985
Buildings	122,850
Rolling stock	225,000
Grading	508,768
Track and line labor	156,361
Track material	393,612
*Line material	474,015
Portage road subway	100,000
Engineering and interest during construction	324,759
Total	$3,872,350

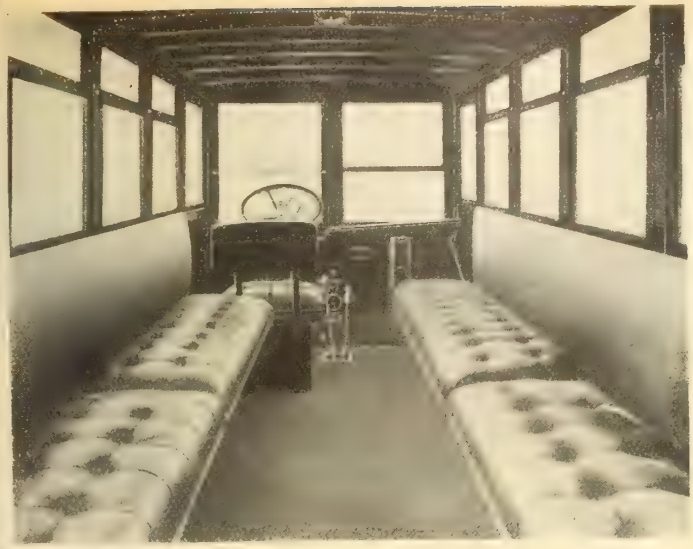
*In the item for line material is included an item for a complete signal system; cost about $90,000.

Winnipeg Electric Railway Company Inaugurating Competition for Jitneys

The Winnipeg Electric Railway Company, having suffered tremendous financial hardships owing to competition of jitneys, has now decided to give the latter a taste of their own medicine. To this end a number of motor busses are being placed on the routes now operated by jitneys. Herewith are shown interior and exterior views of motor bus, which is the type adopted by the railway company. Transfers will be issued to passengers valid on street cars at points of junction. Contracts for busses were placed on March 9th.



Exterior View W. E. R. Co. Motor Bus



Motor Bus will seat 16 passengers

Each vehicle has a capacity of 16 passengers and the running schedule will be from 6 a.m. until midnight. The door has no handle and consequently passengers cannot open it to enter or leave the car while in motion. The bus is built on a one-ton truck chassis, with interior equipment similar to that of the standard street cars. Broad leather upholstered spring cushion seats, curved back rests, two dome lights, and electric push buttons are features that add to the comfort of the passengers, while the wide space between the seats gives ample room for comfort. For winter weather, heaters will be placed in the busses. There will not be any conductor; passengers will deposit their fares as they enter the bus.

Quebec Asking for Increase in Fares

Mr. W. J. Lynch, manager of the Quebec Railway, Light, Heat & Power Company, has applied to the City Council for authorization of an increase in fares on the electric railway line. He bases his application on the increase in the materials incidental to the operation of a public utility company, a list submitted showing an average increase between June, 1913, and June, 1917, of 109.3 per cent. This does not include cost of labor, which has also very substantially increased. Mr. Lynch also submitted a list of 41 street railway companies which had increased their fares between January 1st, 1917, and January 1st, 1918. The company ask for a five cent fare, 5 tickets for 25 cents, 21 tickets for a dollar; abolition of workmen's tickets; school children's tickets to remain at ten for 25 cents, but all children, excepting those in arms, to pay a three cent cash fare; transfers 1 cent cash.

M. & S. C. Building New Station

At an early date the Montreal & Southern Counties Railway Company will erect a new station, freight and general offices on Youville Street, Montreal. The building will be of three storeys and constructed of steel, concrete, and pressed brick. The present station is very small and the offices are in the Canadian Express Building, McGill Street. The company has concluded an agreement with the Montreal Tramways Company, by which a loop line will be constructed around the terminal station of the Southern Counties Railway Company, involving the crossing of the Tramways Company's lines. This will enable a more speedy handling of the cars.

Municipal Electrical Engineers Organize

(Continued from page 33.)

pers Committee; 3. Convention Committee; 4. Rules and Regulations Committee. Each Committee shall consists of a Chairman, with at least two other committee members elected by the Association at large. The Chairman of these standing committees, with the Executive officers of the Association, shall constitute the executive committee. The President is a member ex-officio of all committees.

Elections

The election of officers and standing committees shall take place at the first regular meeting in each calendar year.

The presiding officer at this meeting (President or Vice-President) shall select from the Class "A" delegates present, three men to act as a Slate or Striking Committee, who shall immediately adjourn and prepare a suggested list of officers and members of standing committees to be voted upon, at least two names being suggested for each office. Other nominations made by the meeting at large will be permitted, including the nominees of the Slate Committee. Voting shall be by ballot, and each Class "A" delegate present shall have one vote for each officer—the majority of the votes cast shall elect. A separate ballot shall be taken for each office. The new officers shall take their positions immediately after the dissolution of the general meeting at which they are elected.

Fees

An annual fee shall be assessed against each Member Utility in accordance with the following scale, based upon the number of electrical consumers at the end of the previous calendar year.

Less than 250	consumers	$2.00
251— 500	"	5.00
501— 1,000	"	7.50
1,000— 2,000	"	10.00
2,001— 3,000	"	15.00
3,001— 5,000	"	25.00
5,001—10,000	"	35.00
Over 10,000	"	50.00

Electrical Heating Publication

Of interest to everybody connected with the heating of baking, drying and japanning ovens is a reprint just issued by the Westinghouse Electric and Manufacturing Company, of East Pittsburgh, Pa. This includes an article, "Electrically Heated Japanning Ovens," by C. F. Hirshfield, reprinted from the N. E. L. A. Bulletin, and "Heat Calculation for Baking and Drying Ovens," by W. S. Scott, reprinted from the Electrical Journal. Thus there are grouped under a single cover an article giving general considerations in favor of electrical heating for this purpose and an article giving the detailed method of calculation for the amount of heat required to raise the temperature of the work, of the supporting and carrying parts, such as trucks and of the ventilating air. How to compute the losses from the external surface of the oven, and the heat required to raise the temperature of the oven walls, etc., are also given. This publication should be of much value to central station solicitors who are endeavoring to interest their customers in the electrical heating of ovens, as well as to present and prospective users of such equipment.

National Association in New Quarters

Dating from March 30, 1918, the National Association of Electrical Contractors and Dealers have permanently appointed their headquarters at Room 1703, 110 West 40th Street, New York.

The Dealer and Contractor

Magnetic Advertising—Some Basic Suggestions for the Contractor-Dealer

By F. S. Ackley*

Manufacturers and large retail establishments are able, consistent, and, hence, highly successful advertisers. Many large businesses have been built up by the publicity method. But the rank and file of small stores, particularly electrical stores, are poor advertisers, most of them doing practically no advertising worthy of the name.

Advertising does not necessarily mean buying newspaper space. That is only one feature of a well-planned campaign. In fact, many good advertisers do not use newspaper space at all and almost never run "campaigns." Advertising, in its broader sense, is serving notice on the public that you are in business in a certain line, and doing it so as to pull trade to your store. You can do this in many ways, from hanging up a sign over your door to running full pages in every newspaper in town.

Three Functions

In brief, advertising has three principal functions—to attract attention, to arouse desire, and to turn that desirer in your direction. Any publicity that does these three things well is good advertising. If a poster, a letter, a newspaper ad. or a window display gets the customers into your store it has done its part—the rest is "up to" your salesmen. They must make the sale, and the goods and the treatment accorded customers must hold the trade thus obtained.

There are two main classes of advertising—the kind that costs practically nothing and the kind that costs considerable. In the first class are store front, window displays, store arrangement, and store service. You don't have to spend any more money to give proper care to these details than to give them careless attention. Common sense and a little originality are all that is needed.

The more costly forms of advertising are newspaper, billboard, circular letters, street car publicity, and such efforts depending upon the circulation of the printed word. They are worth all they cost, but some forms are better adapted to certain businesses than others.

Let us first consider the class of advertising that requires but little expenditure—the kind that the smallest merchant should use and that the largest establishment cannot afford to neglect.

"Here I Am!"

Is your store simply one of a hundred without a thing to distinguish it from its neighbors or from the other electrical stores in town? Or does it stand out from its surroundings and say, "Here I am!" to every passerby?

A good store must have individuality. It must attract attention to itself. It must get itself known outside its immediate neighborhood. This can be accomplished by careful attention to the details of outside appearance and inside service and arrangement. Night illumination is a big factor.

If a store is to attract the attention of passers-by it should have some definite distinguishing feature. If its neighbors are dingy in appearance, fresh new paint, clean, modern windows, and a better sidewalk will accomplish the necessary. If the store is in a good business neighborhood perhaps a novel or particularly handsome sign and a different color of paint or a different shaped window will be needed. Nothing should be done to offend the eye, however, as it is favorable attention that must be attracted.

Change Often

Change the window display often and make each display interesting. Make the store arrangement inviting also. These two things will attract atention and draw trade. Make the store a bright spot at night—good illumination is a sales magnet.

Another form of publicity that does not cost the retailer anything is the leaflets that every manufacturer supplies for advertising his products. Whenever you make a sale, wrap up with the article sold a leaflet on a similar device. If you sell a washing machine, for instance, see that the customer gets flatiron or ironing machine literature. Be sure that you have price and terms marked on the leaflet. Nothing is to be gained by concealing the price, even if high. Your store arrangement can also be used to call new appliances to your customers' attention. Counter display cards and wall hangers are also valuable.

Sales Helps

Too many dealers underestimate the value of manufacturers' free sales helps. This material costs the manufacturer a great deal of money, and will sell goods if given a chance. Most manufacturers do magazine advertising also, and such advertising creates business for someone—this is a proved fact. It will bring business to you if you tie up to it by means of the good material offered you.

If you maintain a delivery auto or wagon you have another opportunity for free advertising. Posters or a painted sign on this vehicle will carry your message to every quarter of town and, if the "copy" used be properly handled, will bring in business.

The subject of advertising requires study, and such study will be well worth your while. Electrical trade papers carry, every month, excellent suggestions for publicity work. Every one of them can be adapted to your needs. Try them out—it will pay. A live dealer is always on the alert to pick up ideas and use them, and you should be able to get at least one or two business building ideas from every issue of this magazine. Success has always hinged upon the ability to take advantage of every opportnuity. These articles are intended to help you recognize such opportunities when they appear.

Spending Money

Let us now consider the forms of advertising which require an expenditure of money. Of these perhaps the commonest is newspaper advertising. The space of this article does not permit details, but the following principal rules are fundamental:

Advertise regularly. Spasmodic publicity produces at best spasmodic sales. "Keeping everlastingly at it brings

*In National Electrical Contractor.

success." If you want a steady business you must keep after it steadily.

Make your advertisements interesting and change the copy often enough to keep that interest alive. Large space is not necessary, but the "business card" form of publicity is worth very little. Classified advertisements have frequently been used with good effect.

Always use a picture in your display space. Pictures are almost certain to attract the eye. You can get good cuts free from the manufacturers of the appliances you sell.

It is best to secure a fixed place in the paper for your regular announcements, and try to use a clear type, with the balance of white space so proportioned as to give attention-attracting individuality to your advertisement. Don't crowd and don't use too small type or more than one or two sizes, and any good newspaper office will help you arrange your advertisement so as to get the best effect.

Seasonable Advertisements

Advertise seasonable things in a live way. Anything worth doing at all is worth doing well, and care spent in filling the space you have paid good money for will make the cost worth while.

Motion picture slides of seasonable subjects are also good advertising and not very costly. Manufacturers will supply you with free slides.

Closely allied to this form of publicity are posters in public places, painted sign boards, and street car cards. Practically the same rules apply to such advertising as to newspaper publicity, except that illustrations here must carry most of your message by themselves. There is little room for copy. Manufacturers supply good material for this work. and will tell you how best to use it.

Business by Mail

Advertising by mail, though costly, will, if properly done, bring big returns. Volumes have been written on this subject, and it is impossible to do more than touch upon it here.

Much depends upon your mailing list. For an electrical appliance dealer the telephone book can be used to form the basis of a pretty good list, although each name should be carefully scrutinized. Previous customers who have not bought lately are good prospects, and so are the owners or tenants of houses that you have wired. Time can profitably be spent in making up a good mailing list, as each name costs money in postage and stationery, and there should be as little waste as possible.

Having secured a good mailing list, the next thing is to plan good letters. Letters should be seasonable, sensible, and forceful. They should have a definite purpose, and should not depart for a single sentence from that purpose. Always write about what you are selling from the customer's viewpoint. If you are trying to sell a flatiron, tell the customer what it will do for her in saved steps, lighter labor, freedom from heat, etc. Then make your price and terms seem attractive to her and make it as easy as you can for her to take favorable action. If you have done all these things well and not made your letter too long, you have a good letter.

Keep careful track of all letters sent out. check returns, follow up enquiries, and record sales. You can thus tell if your attempt has been worth while, and can get data for future use.

One at a Time

Don't stuff a letter with a lot of folders. One folder on the same subject as the letter is enough. Too much literature confuses the mind of the prospect. One thing at a time accomplishes the best results in letter-writing, newspaper advertising, and most other forms of publicity.

Just a word on follow-up before leaving this subject.

Don't be content with the returns you get from a single letter. At least three letters on one subject should be sent before you drop it. Keep after the prospects who have not been influenced by your first appeal—send them new arguments, new information.

Don't neglect enquiries. This is the most important part of follow-up. Poor handling of enquiries is responsible for the loss of many sales. If you can't go yourself or send a salesman, be sure you write the prospects at once a personal letter, giving all the information asked for, and, if possible, make an appointment to see the customer. Use the telephone. Keep after the prospect as long as there is any chance for a sale. If sufficient interest has been aroused to get an enquiry, there ought to be no serious obstacle between you and the sale.

Just Simple Rules

It may seem that the simple rules laid down in this article are self-evident—they are! But how often they are overlooked! Statistics show that there are 95 per cent. of failures in the business world every year—think of it! Only 5 per cent. of business men are successful. Attention to detail—intelligent application of basic principles is the road to success in any endeavor; and it has been the purpose of this and preceding articles to point out this road.

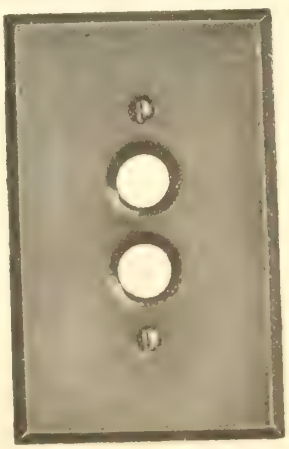
Toronto Electrical Contractors

The regular monthly meeting of the Toronto Electrical Contractors' Association will be held at the usual time and place—Walker House, 7.30—on Thursday, April 4. The president, Mr. K. A. McIntyre, will just be back from Detroit, fresh from a conference with the now famous W. L. Goodwin and other prominent members of the National Electrical Contractors' Association of the United States, and will have some interesting information to pass along.

If there's time, the discussion on accounting will be advanced a stage. There is also that matter of licensing, in which all contractors are so vitally interested. Mr. McIntyre has gathered a lot of information on this subject, too. so come prepared to express your views.

Canadian Made Switch Plates

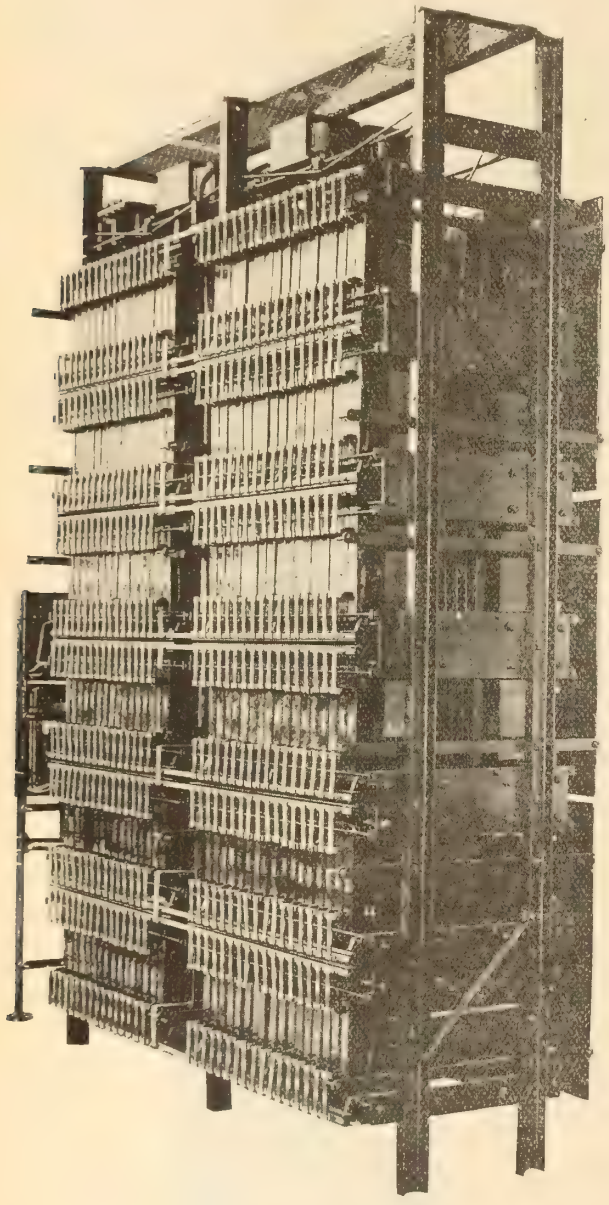
Single gang flush switch plates are now being manufactured in Canada by W. H. Banfield & Sons, Limited, Toronto.



Three styles are at present produced—blank plates, receptacle plates and No.'s 7054 and 7055 in .032 and .025 gauge. The company state they will be glad to mail samples upon request.

Static Condensers

The Canadian General Electric Company has recently developed a commercially successful type of static condenser for power factor improvement on moderate capacity feeder circuits. This static condenser consists essentially of a number of condenser sections similar to those used with generator voltage regulators. A number of improvements have been made to adapt these sections for power service, although the metal foil and paper construction is maintained. The foils and paper are assembled in oil in a metal container to increase insulating properties. In addition to the condenser sections, each equipment includes a reactance for each line leg, discharge resistance rods for each phase, a fuse in series with each cendenser section, and a switch for controlling the equipment. The static condenser has no rotating or reciprocating parts. It is connected directly across the line on which it is desired to improve the power factor.



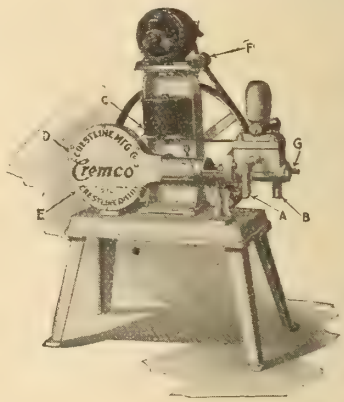
Static Condenser, 300 K.V.A., showing arrangement of Condensers

Standard equipments are controlled by an oil circuit-breaker supplied with overload trip. A low voltage release is not furnished as it is considered unnecessary to disconnect the device from the line in case the power goes off. No attendant is required to operate this condenser. To place it in operation, the control switch is closed and to remove it from service the switch is tripped open. It may be left on the line indefinitely with only an occasional inspection to see that it is operating satisfactorily. Because of this, the equipment may be installed in any out of the way space, or in a sub-station that may be inspected only monthly, or even at longer intervals. The operation is practically noiseless.

Static condensers are standard for installation on circuits ranging in frequency from 40 to 125 cycles, in voltages from 440 to 2300, and may be furnished in any capacity—though the present standards range from 50 kv.a. to 400 kv.a.

New Electrically Operated House Pump

A new small capacity electrically-driven pump has been developed by the Crestline Mfg. Company, Crestline, Ohio, which is especially suited to replace the common water lift to pump rain water for soft water in residences. It can also be used for general water supply in homes when city water supply service is not available and the pump can be placed so the suction lift will not be over 25 feet. The outfit is made in two capacities—Model "A" single cylinder with a capacity of 125 gallons per hour, and Model "B," with a capacity of 250 gallons per hour. Both will operate against a pressure of 50 pounds per square inch. An automatic controller switch is connected with the discharge and is set to



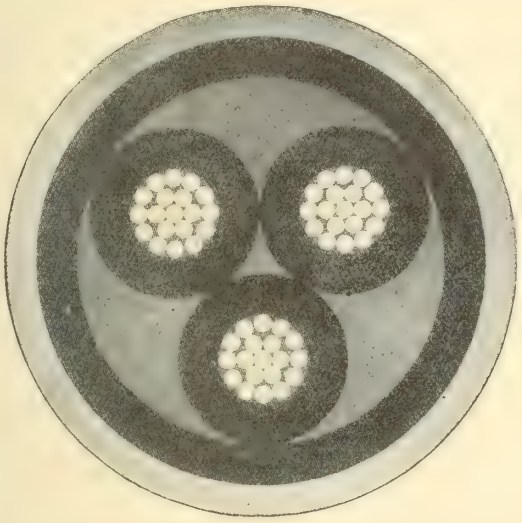
operate between pressures of 40 pound maximum and 20 pounds minimum. It can be adjusted, however, to operate at any desired pressure. The pump gears run in oil, and this same oil is automatically carried to all the pump bearings. The only oiling necessary therefore, is to place one quart of oil in the oil chamber on starting. This will be sufficient for one year's normal service. The cylinders are brass lined, have a 1½-inch bore, 3-inch stroke, and are self-primed. An air valve provides sufficient air for pneumatic pressure tank system. The valves are bronze and rest in bronze seats. The pump and motor are mounted on a cast iron base. The pump is a slow speed type which is connected to the motor by belt with idler pulley attachment. Pressure tanks are also supplied when ordered. Model "A" is fitted with a 1/6 horse-power, and Model "B" with a ¼ horse-power Robbins & Myers motor.

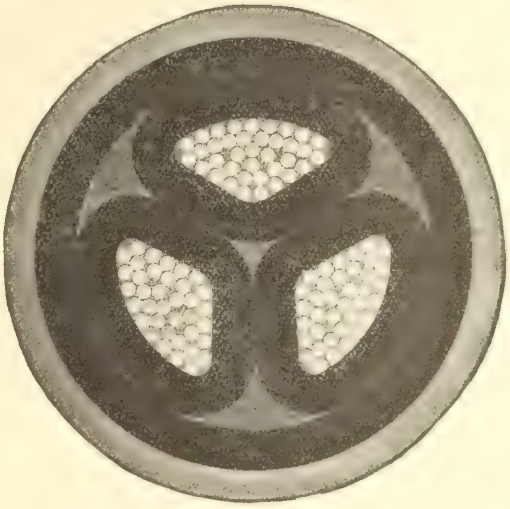
A Fine Lighting Scheme

One of the most interesting features in connection with the new Toronto Art Museum, which opens its doors to the public in a few days, is the illumination. Concealed units are used throughout. These consist of "daylight" lamps, placed above a diffusing glass ceiling. The effect is a most startling approach to a real daylight illumination, both in color and intensity. The installation throughout is one of which Mr. George J. Beattie, the electrical contractor, has every reason to be proud.

PHILLIPS' CABLES

as supplied to the Toronto Hydro Electric System





These illustrations show cross sections in the original size of cables recently supplied to the T. H. E. System and reordered by them for further extensions. The specifications are as follows.—Conductors composed of 37 strands each, .082 in. diameter. Thickness of dielectric on each conductor, .210 in. Thickness in belt, .210 in. Thickness of lead sheath, .160 in. Overall diameter, 2.61 in., 250,000 C.M. Three Conductor, Paper Insulated, and plain Lead Covered Cable for 13,200 volts. We can supply you with wires and cables of any size for Power, Lighting, Telephone, Telegraph, etc.

Write us for detailed information.

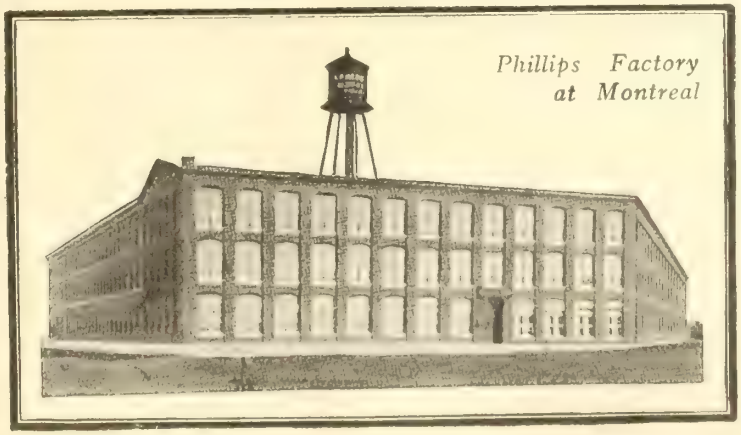
NOTE.—Specification of cable in left-hand cut: 3/0 B. and S. Three conductor. Each conductor 19 strands, each .094 in. diam. Thickness of dielectric on each conductor, .21 in. Thickness of dielectric on belt, .21 in. Thickness of lead sheath, .15 in. Overall diameter, 2.60.

Specification of cable in right-hand cut: As stated in copy.

Eugene F. Phillips Electrical Works, Ltd.

Head Office and Factory: MONTREAL

Branches: Toronto Winnipeg Regina Calgary Vancouver



Phillips Factory at Montreal

Current News and Notes

Brantford, Ont.

The annual statement of the Brantford Municipal Railways Commission shows a net deficit of $195, compared with $1,195 in the previous year. The revenue totalled $111,972, an increase of $13,834, although operating expenses have increased $12,834.

Brockville, Ont.

The Brockville Hydro-Electric Commission contemplate the installation of additional switchboards and switching equipment in order to handle additional business which it is anticipated will come from some of the large manufacturing plants likely to change over from steam to electric power.

Carleton Place, Ont.

The Hydro-Electric Power Commission of Ontario has been asked to make a valuation of the local private plant, with a view to its being purchased by the municipality and a supply of Hydro power being arranged.

Collingwood, Ont.

A 300 kv.a. synchronous condenser has been installed by the Collingwood Hydro-Electric Commission for correcting the power factor.

Cookstown, Ont.

Construction work has been started on a distribution system in Cookstown, Ont., and it is expected power will be delivered within a short time from the transmission lines of the Severn system of the Ontario Hydro-Electric Power Commission.

Drummondville, Que.

Plans are being completed by the Southern Canada Power Company for their development at Drummondville, Que., and work will be proceeded with immediately. The plant will have an ultimate capacity of 20,000 h.p., although about 10,000 h.p. will be the initial output.

Durham, Ont.

A 1,000 kv.a. frequency changer set has been installed in the plant of the National Portland Cement Company, Durham, Ont., and power will be supplied from the Eugenia system of the Hydro-Electric Power Commission.

Eugenia Falls, Ont.

Construction work in connection with the extension of the Eugenia Falls power-house of the Hydro-Electric Power Commission is progressing favorably, and it is expected that the new 4,000 h.p. unit, which is being installed, will be ready in about six weeks.

Hamilton, Ont.

The Hamilton Street Railway is being severely censured by the travelling public on account of inadequate service and antiquated rolling stock. The same public supported a large fleet of jitneys during the spring, summer, and fall months of last year, which may account, in some measure, for present deficiencies in the electric railway.

Kingston, Ont.

A 350 h.p. synchronous motor has been purchased by the Civic Utilities Commission, Kingston, for water pumping. New office and display rooms have been acquired by the commission on Princess Street.

London, Ont.

The Helena Power Company, London, has sent out notices to all customers that it might be necessary to shut down on May 1.

The figure at which the London and Lake Erie Traction Company has been offered to the city is $420,000. This is on a basis of 50 cents on the dollar of $840,000 bond issue.

Midland, Ont.

A 22,000 volt feeder from the Midland, Ont., sub-station of the Hydro-Electric Power Commission will be constructed to supply the plant of the Midland Shipbuilding Company. Three 300 kv.a. transformers, with necessary metering and protective equipment, will be installed in an outdoor sub-station. The local sub-station is also being extended and enlarged to permit the installation of an additionl bank of transformers. A 300 kv.a. synchronous condenser is also being installed in the Midland sub-station.

Ottawa, Ont.

Statistics tabled in the House of Commons recently show that in 1917 Canada had one telephone for every 13.4 persons. This compares with one to 19.3 in 1912. The total number of telephones is 604,136; number of companies, 1,659; wire mileage, 1,788,202.

Perth, Ont.

The town of Perth contemplates remodelling their street lighting and distribution system this spring, and will change over from 133 to 60 cycles.

Smith's Falls, Ont.

Work will be started in the near future on a sub-station at Smith's Falls which will supply the municipality with power purchased from the Rideau Power Company, at Merrickville, Ont.

Toronto, Ont.

Gross profits of the Canadian General Electric Company for the year 1917 show a slight decrease compared with 1916. The figures are $2,051,609 in 1917 and $2,225,912 in 1916. The cause is given as higher cost of labor and the decreased price received from munitions contracts. Dividends amounting to $780,000 have been paid, leaving a net surplus of $353,596 for the year. Hon. Frederic Nicholls, president, in his annual report, stated: "While contracts for munitions have fallen off very materially, our sales of standard machinery and supplies continue to improve." The detachment of twenty-five electrical and mechanical engineers contributed by the company for service during the continuance of the war has been, and will be, continuously maintained. In addition to contributions to the Canadian Patriotic Fund, Red Cross Society, and other war-time funds, the Canadian General Electric Company have allotted the sum of $2,297,500 to Canada's Victory War Loan.

Winnipeg, Man.

Gross earnings of the Winnipeg Electric Railway Company for 1917 were $3,339,000; operating expenses, $2,143,512. The net surplus was $92,579. It is interesting to note that, while earnings show an increase of $17,840 over 1916, operating expenses increased $204,471.

Trade Publications

C.G.E. Publications—Bulletin 68201, Drum Type Switches, CR-3900, for throwing small a.c. or d.c. motors across the line, reversing or non-reversing; Bulletin 68410, Automatic Starters for d.c. motors—current-limit-acceleration—for the automatic starting and stopping of series, shunt or compound-wound motors.

Condulet Suggestion—No. 14, by the Crouse-Hinds Company of Canada, describing how perfectly conduits and condulets are suited for use in direct motor-driven machinery. An actual installation is illustrated.

Railway & Power Engineering Corporation, Limited

Railway, Light and Power Equipment

MONTREAL
Power Bldg.—Tel. Main 5667

Head Office—TORONTO

TORONTO
Can. Pac. Ry. Bldg.—Tel. Adelaide 2675

"USED EQUIPMENT DEPARTMENT"

WE HAVE FOR SALE. Let us quote you on the following Equipment:

Motors

3 PHASE—25 CYCLE

No.	H.P.	Make	Type	Volt	R.P.M.
1	1200	G. E.	I.P.	2080	250
5	175	West.	C.S.	220/440	480
4	125	West.	C.K.	220/440	480
1	100	G. E.	J.K.	220/440	1500
2	50	West. (25 or 30 cycle)	C.S.	2200	750/900

3 PHASE—60 CYCLE

No.	H.P.	Make	Type	Volt	R.P.M.
1	1000	West.	H.F.	2200	360
1	300	A.C.	ANY.	2200	505
1	300	G. E.	ATI.	2300	225
1	200	G. E.	ATI.	2080	600
3	250	Burke	Ind.	6600/2200	514

Transformers

25 CYCLE

No.	K.V.A.	Phase	P. Volt	S. Volt	Make
4	1000	1	45000	12000	G. E.
3	375	1	13200/6600	440/220	A. C.
3	100	1	13200/6600	2200	G. E.
4	100	1	2200	370/185	G. E.
2	100	1	2200	440/220/110	West.
3	50	1	16500	2200	West.
3	30	1	2200	550	G. E.
3	20	1	2200	550	Moloney

60 CYCLE

No.	K.V.A.	Phase	P. Volt	S. Volt	Make
3	6500	1	26000/19000 16000/11000	4400/2200	West.
4	1850	1	33000	600	West.
4	1800	1	23000/11000	2200	G. E.
3	300	1	2200	110/220	Pittsburgh
3	670	1	2300	105/90/70/60	G. E.
12	250	1	6600	2300	G. E.
6	185	1	2200	155	West.
3	100	1	13200/6600	2200	G. E.

Belted-Generators

DIRECT CURRENT

No.	K.W.	Volt	Wdg.	Type	R.P.M.	Make
1	500	550	C.P.	M.	320	West.
1	450	550	C.P.	S.	800	West.
1	22	500	C.P.	M.	575	West.
1	450	250	C.P.	M.	320	West.
1	100	250	C.P.	M.P.	475	C. & C.
2	75	250	C.P.	S.	575	West.
1	125	125	C.P.	M.P.	600	Sprague
1	100	125	C.P.	....	720	Burke
1	65	125	C.P.	FH.	875	G. E.
1	35	125	C.P.	S.	725	West.

ALTERNATING CURRENT

No.	K.V.A.	Volt	Ph.	Cy.	Type	R.P.M.	Make
1	250	2300	3	60	A.T.B.	600	Burke
1	150	220/440	3	60	A.T.B.	600	G.-E.
1	120	220/440	3	60	G.	900	West.
1	100	2200	3	60	T.R.B.	900	Ft. Wayne
1	90	220	3	60	I.C.	1200	Lincoln
1	75	2300	3	60	R.L.C.	276	W. E. Co.
1	60	220	3	60	B.	900	F. M. Co.
1	50	2200	3	60	G.	1200	West.
1	50	250	3	60	A.T.B.	1200	G. E.
1	25	240	3	60	A.T.B.	1800	G. E.

Engine Generator Sets

DIRECT CURRENT

1 500 KW., 550 volt, 320 R.P.M., C.P. W.D. Westinghouse 3-bearing Generator, belted to Allis-Chalmers Corliss Steam Engine; 150 lbs. steam pressure.
1 550 KW., 250 volt, 100 R.P.M., C.P. Wd., Bullock Generator, connected to 22 x 36 x 42 A.C. Co. vertical compound non-condensing engine.
1 200 KW. Triumph, 250 volt, 150 R.P.M., Russel 4-valve engine.
1 100 KW. Westinghouse, 250 volt, 250 R.P.M., straight line engine.
1 75 KW. Westinghouse, 125/250 volt, 275 R.P.M. Westinghouse Engine.
1 50 KW. Westinghouse, 125 volt, 275 R.P.M. Ideal Engine.

MOTOR GENERATOR SETS

1—300 K.W., G.E., 125/250 volt, 720 R.P.M., D.C. Gen., direct connected to one 450 H.P., 3 phase, 4000/2300 volt, 60 cycle, Ind. motor, complete with switchboard equipment.
1—150 K.W., G.E., 125/250 volt, 900 R.P.M., D.C., Gen., direct connected to suitable syn. motor, 2300 volt, 3 phase, 60 cycle, complete with switchboard equipment.
2—30 K.W., 125 volt, Westinghouse, 1140 R.P.M., D.C. Gen., direct connected to one 3 phase, 60 cycle, 220/440 Ind. motor.

SWITCHBOARD EQUIPMENT

39 3P., G.E., 35000 volt, 300 amp., form K. oil switches, either hand or solenoid operated.
11 3P., G.E., 13000 volt, H3 motor operated oil switches, 500 amp.
10—100 amp. 3P. G.E. form K., 10000 volt hand operated oil switches.
12—250 amp., 7000 volt, form K., 3P. hand operated oil switches.
10—200 amp., 4500 volt, form K., hand operated oil switches.

ALTERNATING CURRENT

1—150 K.V.A., G.E., Type A.T.B., 3 phase, 60 cycle, 480 volt, 225 R.P.M., with exciter and 16 x 18 Skinner engine
1—110 K.V.A., R. C. Co., 3 phase, 60 cycle, 240 volts, 277 R.P.M., with exciter, 14 x 15 Skinner engine.
1—105 K.V.A., G.E., Type A.T.B., 3 phase, 60 cycle, 2300 volt, 257 R.P.M. and 14 x 15 Phoenix engine.
1—75 K.V.A., F. M. Co., Type R.E., 3 phase, 60 cycle, 220 volt, 257 R.P.M., with exciter and oil engine.
1—K.V.A., Westinghouse, Type E.T., 3 phase, 60 cycle, 2200 volt, 277 R.P.M., with exciter, 12 x 12 Harrisburg engine.
1—50 K.V.A., G.E., Type A.T.B., 3 phase, 60 cycle, 220 volt, 300 R.P.M., with exciter and 11½ x 12 Ames engine.

ROTARY CONVERTERS.

1—500 K.W., 550 volt, D.C., West. Rotary Converter, 3 phase, 25 cycle, with 3 suitable S.P. transformers, 13200 volt, prim. and 390 volt sec.
4—500 K.W., 600 volt, D.C. Rotary Converters, 3 phase, 25 cycles, with suitable transformers, 6600/5940 volt prim., 430-286-143 volt sec.
1—300 K.W., 575 volt, D.C. Rotary Converter, 370 volt, A.C., 600 R.P.M., complete with 3-185 K.V.A., 60 cycle transformers, 2200 volt prim., 370 volt sec.

MISCELLANEOUS

1—200 h.p. Worthington 2 stage, 12 in. turbine pumps, rated capacity 4000 G.P.M. at 60 lbs. pressure, direct connected to one 100 h.p., 3 phase, 60 cycle, 440 volt, 575 R.P.M. Westinghouse induction motor, complete with auto starter and no voltage release.
1—1160 ft. Sullivan two-stage belt driven air compressor, complete.
1—1586 ft. Sullivan two-stage belt driven air compressor complete.
1—50 h.p. Foss Gas Engine, speed 200 R.P.M., one cylinder, flywheel 4 ft. x 12 in., used only three weeks.

A complete power plant, in first-class condition, dismantled, crated, and ready for immediate shipment, consisting of:
1—Alternator, C.G.E., 60 cycle, type T.T.B., class 48—600—1501, Form E, volt 2,200, amp. 158, speed 150, direct connected to a Rice & Sargent Providence Engineering Works 18 in. x 36 in. x 32 in. horizontal cross compound condensing engine, complete with condensers; Wainwright horizontal copper tube water-heater; switchboard, piping, and valves. Ask for further information.

WE ALSO HANDLE A FULL LINE OF ELECTRIC RAILWAY EQUIPMENT AND SUPPLIES

Our stock changes daily and above list is only a small proportion of what we have. For further particulars wire, telephone or write. Let us solve your problems. All engineering service without obligation. **We advertise and sell your released equipment without cost to you.**

Cable For Sale

[illegible] 1,000,000 C M Triple Braid Wacco Cable, 2500 feet
[illegible] 500,000 C M Triple Brand Wacco Cable, 1755 feet
Subject to immediate delivery and prior sale.
Box No. 707, Electrical News, Toronto. 7

(Public Advertisement)

Tenders Wanted for Electric Wire and Cable

Parliament Buildings, Ottawa

Sealed tenders will be received by the undersigned until noon, April 11, 1918, for the Electric Wire and Cable required in the reconstruction of the above building.

All tenders to be based on the supplying and delivering on the site of the quantities of the schedule of materials for Electric Wire and Cable in strict conformity with the specifications and the samples submitted and to the satisfaction of the Architect.

Deliveries to commence by July 1, 1918, and to continue as directed in such quantities as to ensure complete delivery by August 31, 1918.

The schedule of materials, specification and other information required can be obtained at the office of P. Lyall & Sons Construction Company, Limited, Ottawa.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Minister of Public Works, for a sum not less than ten (10 p.c.) per cent. of the amount of the tender, which will be forfeited if the parties tendering decline to enter into a contract when called upon to do so, or fail to complete the work contracted for. If the tender is not accepted, the cheque will be returned.

Payments for material will be made monthly.

The lowest or any tender not necessarily accepted.

Envelopes containing tenders to be marked "Tenders on Electric Wire and Cable" and addressed to the undersigned.

JOHN A. PEARSON, Architect.
J. O. MARCHAND, Associate.
Centre Block, Parliament Buildings,
Ottawa. 7-7



Generator Set Wanted

Wanted—35 to 50 K.W. 125/250 volt 3 wire D.C. Generator, direct connected to High Speed Engine. Write The Kaufman Rubber Co., Ltd., Kitchener, Ontario. 5-8

Equipment For Sale

The following electrical equipment recently taken out of commission is for sale and may be examined at Ragged Rapids Siding on C. N. O. Railway. Tenders for whole or any part will be received by Orillia W. L. & P. Commission, Orillia, Ont., up to April 10th, 1918.

No tender necessarily accepted.

A marked cheque for 20 per cent. on machinery and $500 on scrap to accompany tender. Payment to be made in full before removal.

1—600 K.V.A. Westinghouse generator, 1200 volt, 2 phase, 222 r.p.m., 36 pole, revolving field, direct coupled to waterwheel.
1—22½ K.W. Westinghouse exciter, 125 volts, direct coupled to waterwheel.
1—Generator switchboard panel, oil switch and meters.
1—Exciter panel, switches and meters.
1—300 K.V.A., S.E.C. generator, 1200 volts, 2 phase, 500 r.p.m., 16 pole, revolving field, inductor type, belt driven.
(Complete new unused armature winding).
1—70 volt, 60 ampere exciter, belt driven.
1—Samson waterwheel, 1200 h.p., 40 in. twin double runner, 33 ft. head, 222 r.p.m.
1—Samson waterwheel, 600 r.p.m., 35 h.p., 33 ft. head, single bronze runner and steel casing.
2—38 in. 3-ply leather belts, endless, 55 ft. long.
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1	50	3	25	550	720	Westg.
1	40	3	25	550	750	C. G. E.
2	40	3	25	550	710	Westg.
2	35	3	25	550	720	Westg.
1	30	3	25	550	710	Swedish
1	25	3	25	2000	900	C. G. E.
2	20	3	25	550	710	Westg.
2	10	3	25	550	720	Westg.
1	7½	3	25	550	1400	Westg.
2	7½	3	25	550	750	C. G. E.
1	5	3	25	550	1440	Excelsior
2	4	3	25	550	1400	Excelsior
2	3	3	25	550	750	C. G. E.
2	2	3	25	550	1400	Excelsior
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1	50	25	550	3	750
1	40	25	550	3	750
1	30	25	550	3	750
1	20	25	550	3	750
1	10	25	550	3	750
1	200	60	2200	3	514
1	150	60	550	3	580
1	80	60	550	3	900
1	40	60	550	3	900
1	25	60	550	3	900
1	20	60	550	3	900

GENERATORS

No.	K.V.A.	CYCLE	VOLT	PHASE	R.P.M.
3	300	60	2200	3	600
1	150	60	2200	3	600
1	75	60	2200	3	600
1	75	60	550	3	900
1	50	60	550	3	900
1	275	25	6600	3	375
1	35	D.C.	250	..	300
1	17½	D.C.	250	..	1100
1	17	D.C.	125	..	850
1	7½	D.C.	125	..	1200
1	40	D.C.	250	..	300

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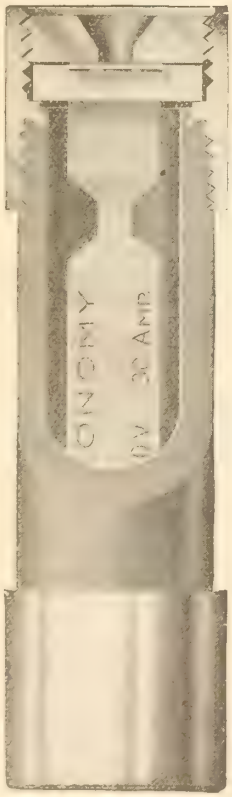
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1	1	Fbks. M. ..	440	B	1200
2	3	R&M NEW.	220		1150
6	3	Wstg. New	220	CS	1150
2	2	G.E.	220	KT	900
4	3	G.E.	220	KT	1800
1	3	G.E.	220	KT	900
3	3	G.E.	220	KT	1200
2	5	G.E.NEW. .	220	KT	1800
3	5	Wstg. New	220	CS	1150
1	5	G.E.	220	KT	1200
1	5	Wstgh.	220	CCL	1700
3	5	Cr.Wh. . .	220	Q	1720
1	5	Wstgh.	220	CCL	1700
10	5	Wstgh. New	220	CS	1735
1	7½	G.E.	220		1800
29	7	C.G.	550		1200
1	7½-15	Cr.Wh..	220/440		865/1735
4	7½	G.E.NEW. .	220	KT	1800
4	7½	G.E.NEW. .	220	KT	1200
6	7½	G.E.	550	KT	1800
2	7½	G.E.NEW. .	220	KT	900
3	10	G.E.NEW. .	220	KT	1800
1	10	Wstgh.	220	CCL	1700
1	10	Wstgh. .. .	220	CS	1150
1	10	Cr.Wh. . ..	550	Q	1800
3	15	R&M	220		1150
4	15	Fbks.M.	220/440	KBV	1200
1	15	Wagner sl.rg. no controller ...	220/440	TBR	1200
2	20	Wstgh. . .	220	CS	1160
1	20	Fbks.M. . .	220	B	1200
50	20	Fbks.M.	220/440	KBV	1200
20	25	Wagner	220/440	BP	1120
1	25	G.E. sl. rg. no controller .. .	220	M	900
2	30	WagnerNEW	220		850
1	35	Triumph	220/440		900
1	35	G.E.	220	KT	600
1	35	G.E.	220	KT	720
1	40	Wagner NEW.	220/440	BP	850
1	40	Fbks.M. . .	220		900
1	40	G.E.NEW .	220	KT	1200
1	50	Triumph . .	220		720
1	50	G.E.NEW. .	220	KT	900
2	50	G.E.NEW .	440	KT	900
1	50	G.E.NEW..	220	KT	1200
1	50	G.E. sl. rg.	220	M	900
1	75	G.E.NEW. .	220	K	900
1	125	G.E.	2200	L	600
1	150	Wstgh. New	440	CW	695
1	263	G.E. Synch. with direct connected exciter	2200		600

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Qu.	H.P.	Make	Volts	Type	Speed
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1	12½	G.E.elev.type-high torque	220	KTE	750
6	15	Allis-Ch. ..	220		750
7	20	Allis-Ch. ..	220		750
2	20	G.E.	440	K	750
1	40	Wstgh. . .	220	MW	695
1	50	Allis-Ch. intermittent duty, sl. rg. drum controller	440		500
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2	50	General Electric	720		
1	50	General Electric	500	I	K
1	35	General Electric	750	I	K
1	35	General Electric	1500		
3	25	General Electric	750	I	K
1	20	General Electric	750	I	K
1	15	General Electric	750	I	K
6	10	General Electric	750	I	K
7	5	General Electric	1500	KT	C

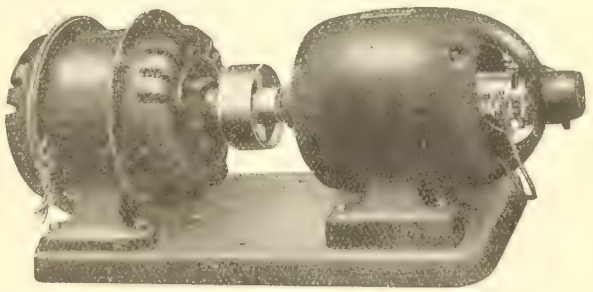
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2	60	General Electric	750	I	K
11	3	General Electric	1500	KT	
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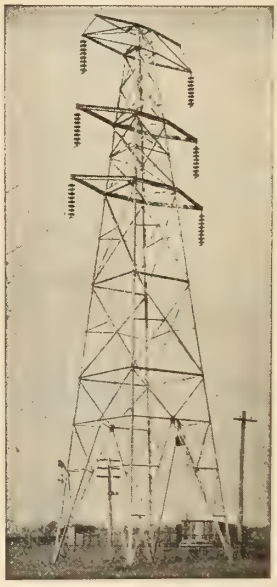
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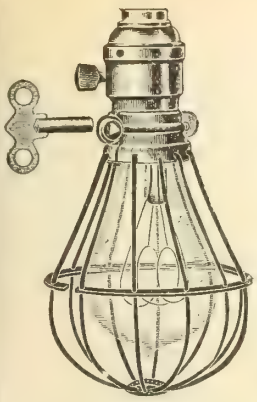
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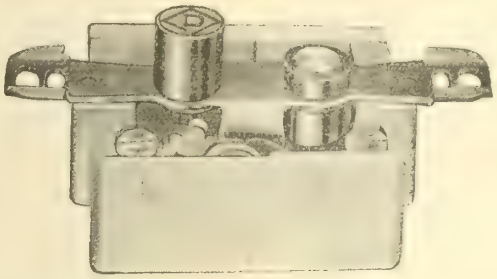
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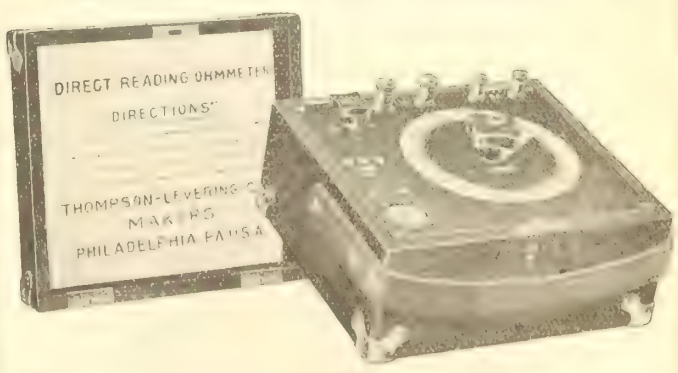
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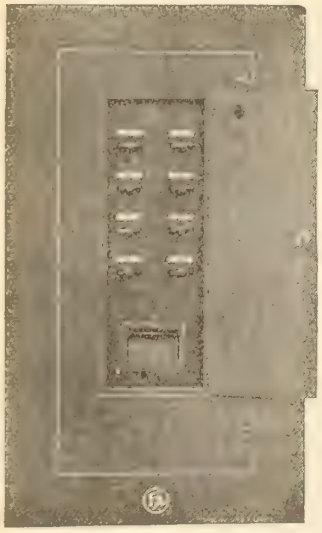
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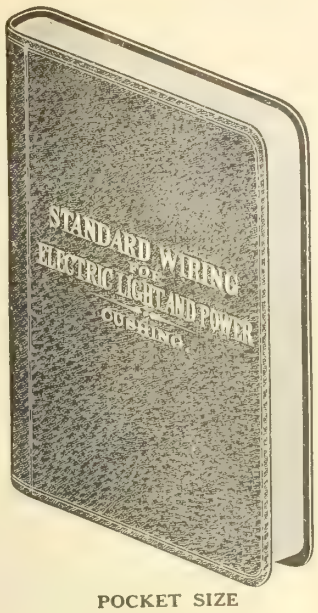
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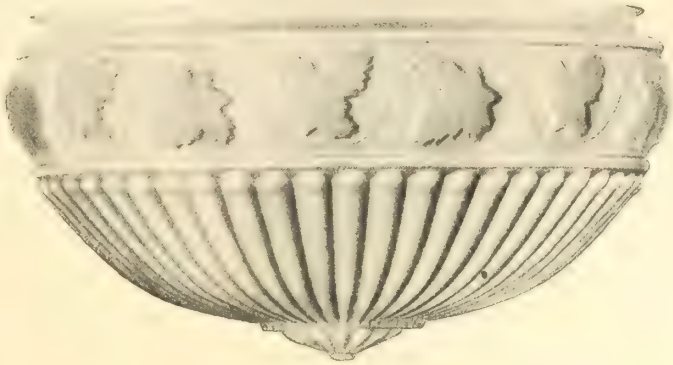
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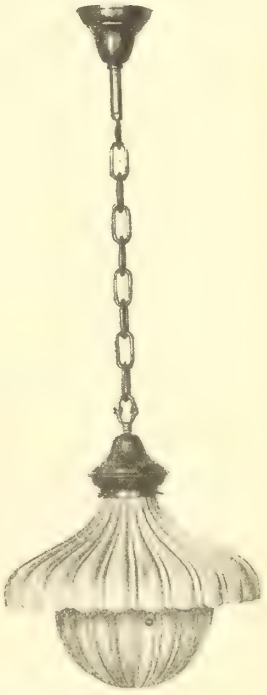
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(Continued on Page 56)

When you put a Wagner Motor to work

you are sure of continuous, dependable power as long as you want it. Is it worth anything to you to know that every motor in your shop is ready every minute to answer the call for power and to stand up even under adverse conditions?

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496

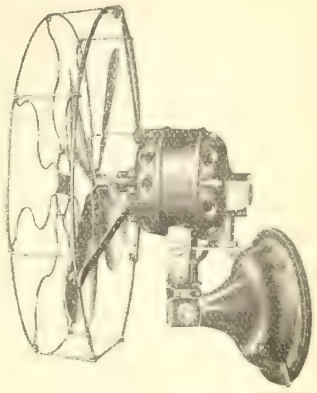
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adds to their appearance and materially lightens their weight without impairing their strength and durability.

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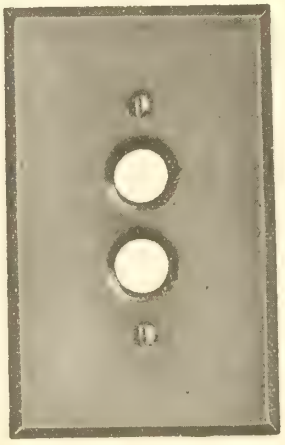
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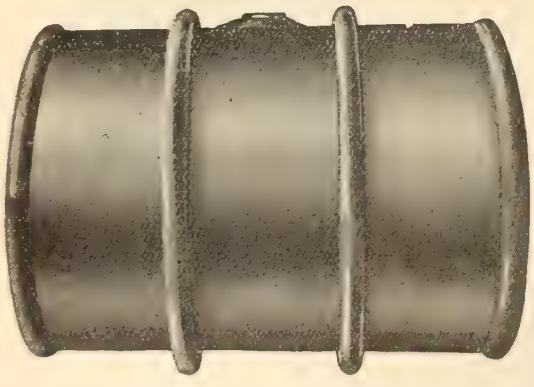
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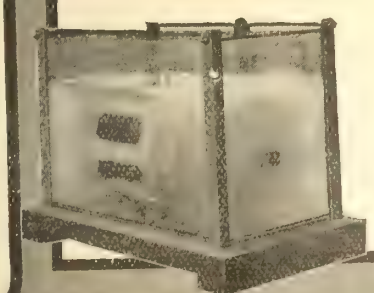
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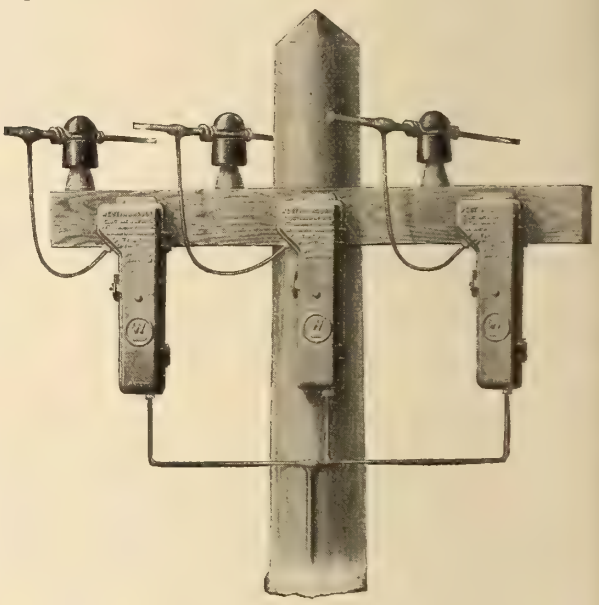
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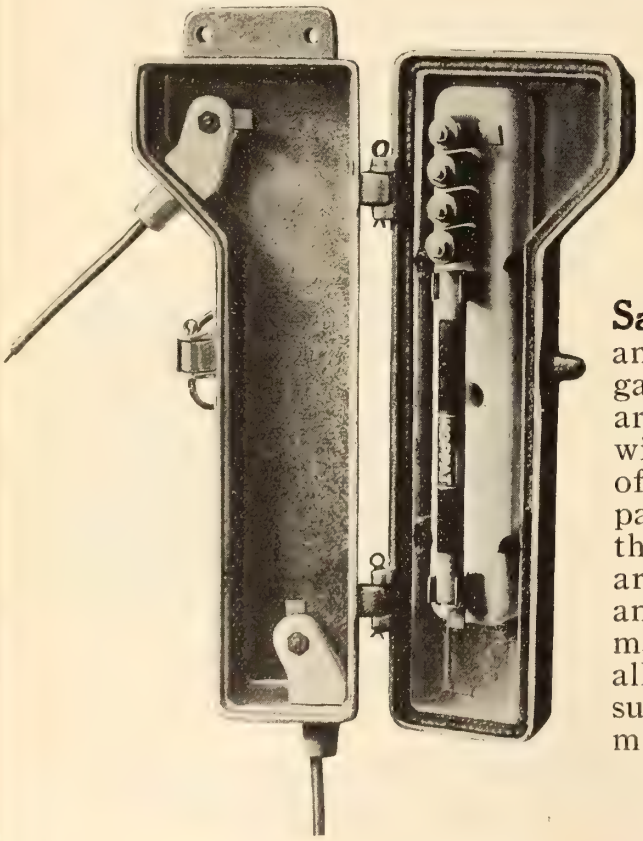
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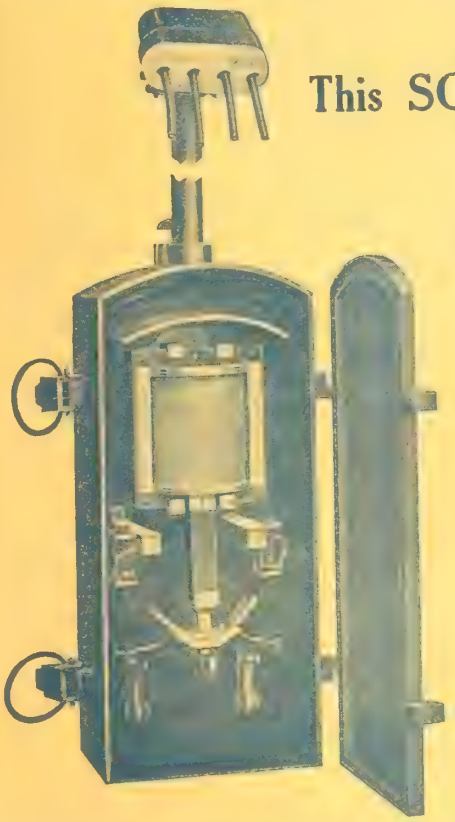


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No springs, swivels or other complicated mechanisms to give trouble. They close magnetically and are opened by gravity assisted by the tension of the laminated copper contact. All arcing is taken up on the carbons.

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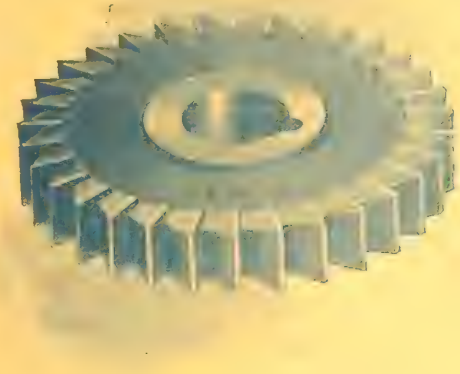
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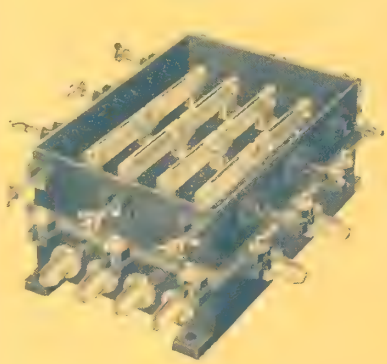
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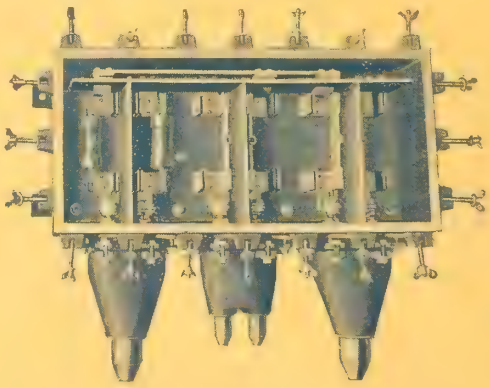
326-328-330 WEST CRAIG STREET
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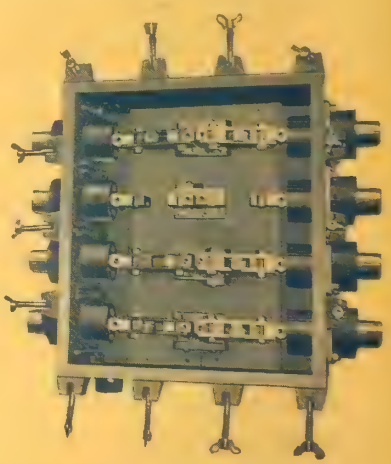
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are easily adapted to any lay out

A G & W Box is engineered at the factory to fit the job; this permits simple installation and relieves you of engineering the job to fit a box.







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Let us show our box as applied to your conditions.

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Electrical News

Generation, Transmission and Application of Electricity

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start and stop with a single throw switch.

Wagner BA Single-phase Motors and BW Polyphase Motors are particularly suited to remote or automatic control or where uninformed or unskilled labor must handle them.

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186





FIGURE 1—FRONT



FIGURE 2—REAR

THE "S.J.B." BOX

FOR SERIES ORNAMENTAL STREET LIGHTING SYSTEMS

¶ To provide a means of disconnecting lamps from circuits supplied with current by two-conductor cable, The Northern Electric Company have recently designed the "S.J.B." Box for use on series circuits operating at potentials of 7,000 volts or less.

¶ Figs. 1 and 2 show front and rear views of the box, and Fig. 3 shows how the box is installed in the pedestal of a lamp standard. This view was taken in Montreal where all of the standards used in connection with the new lighting system are equipped with these boxes.

¶ There are many interesting features in connection with this box, but the limited space at our disposal does not permit of a detailed explanation. To those interested, however, we will be glad to send photographs and full descriptive matter on application to our nearest branch house.



FIGURE 3

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MONTREAL HALIFAX TORONTO WINNIPEG
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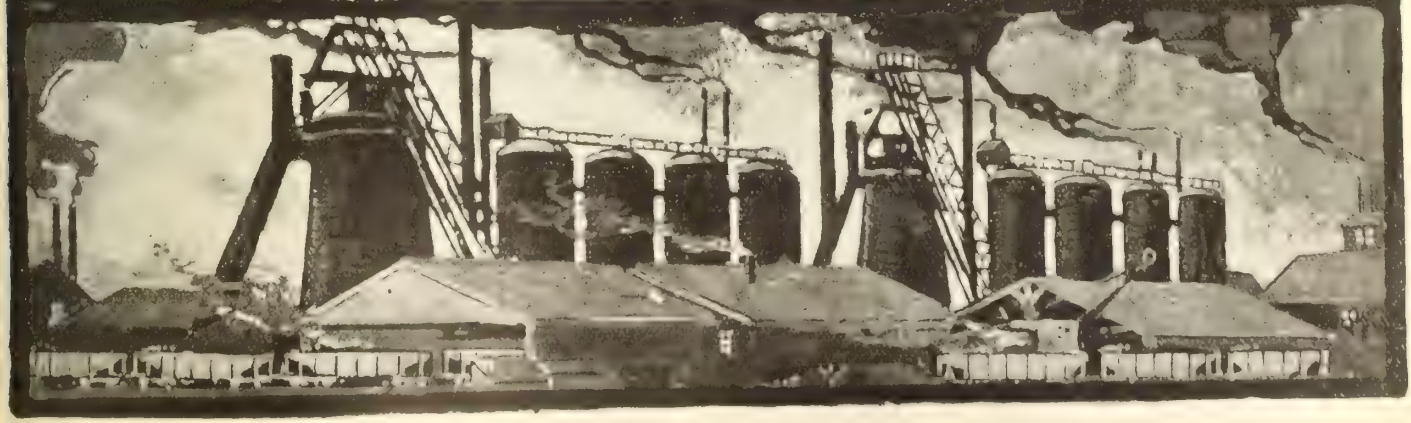


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of course!

All reliable dealers sell it.

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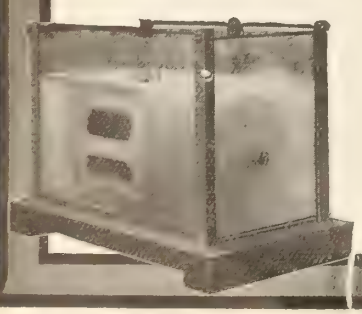
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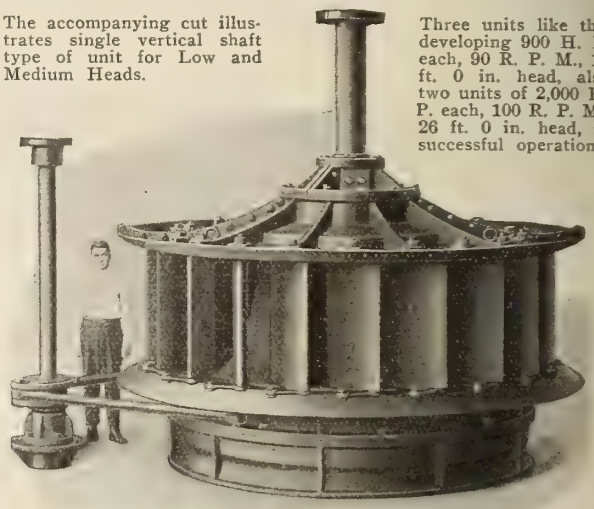
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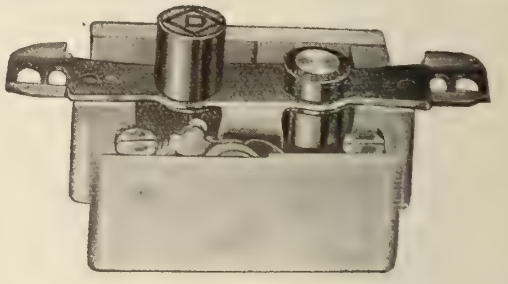
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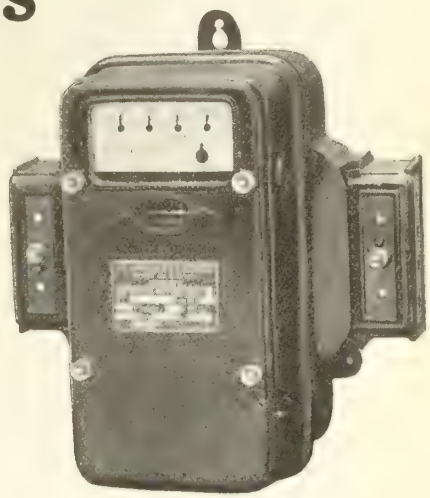
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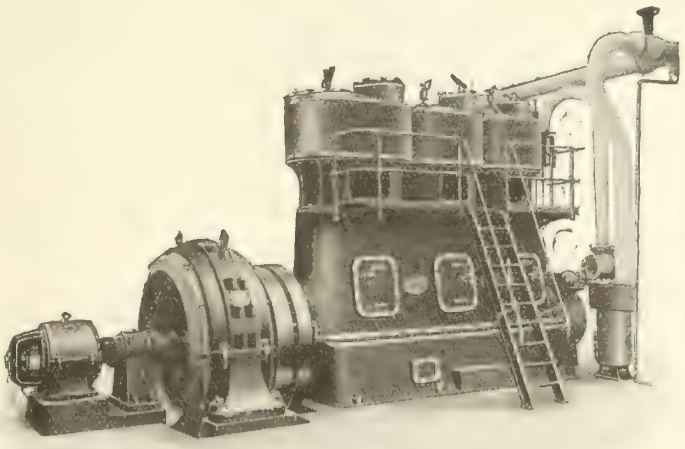
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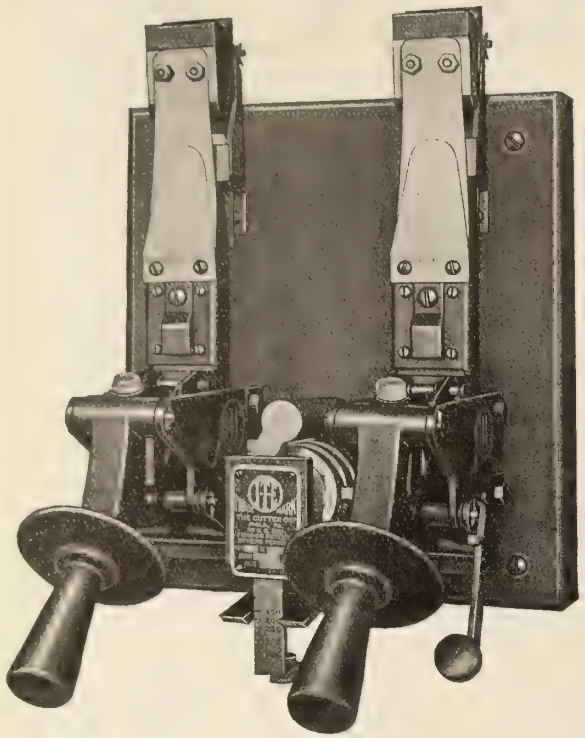
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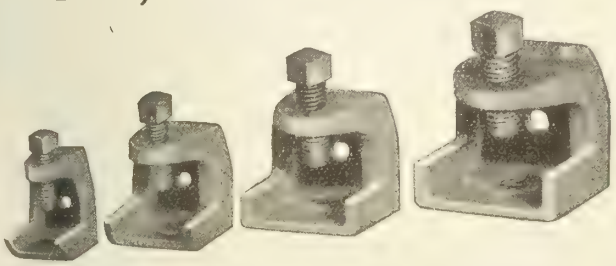
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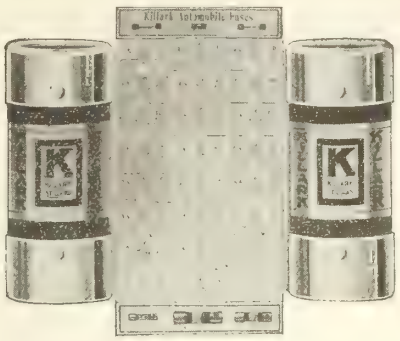
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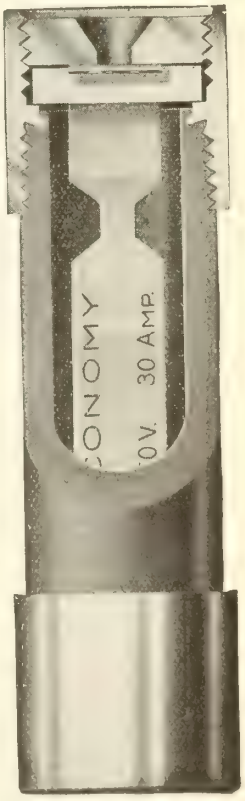
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you will renew your gratification over cutting your annual fuse maintenance costs 80%.



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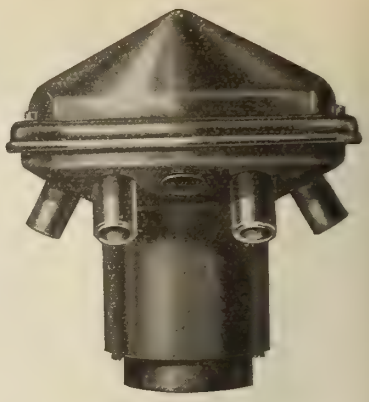
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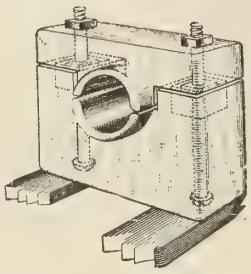
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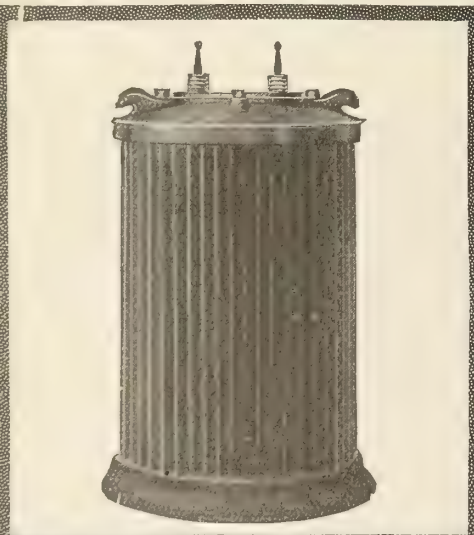


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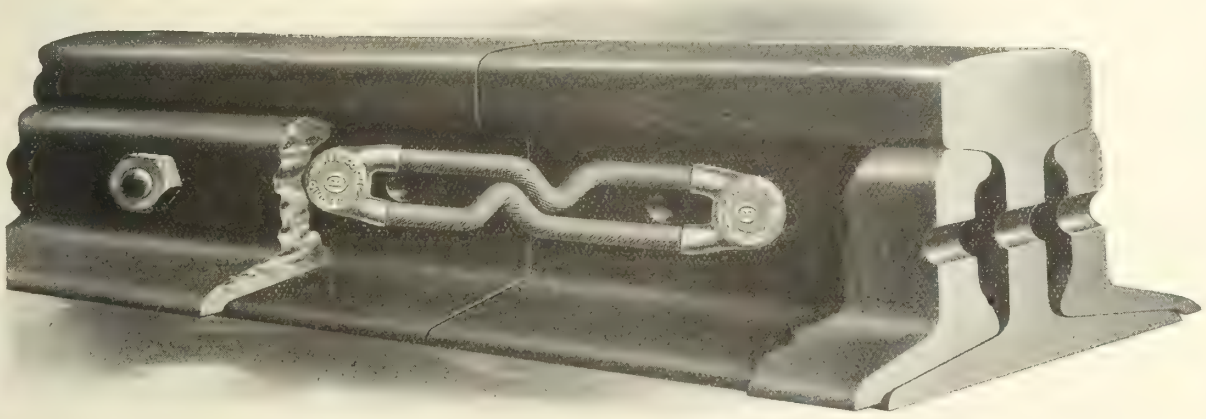
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Fig.1—The Old

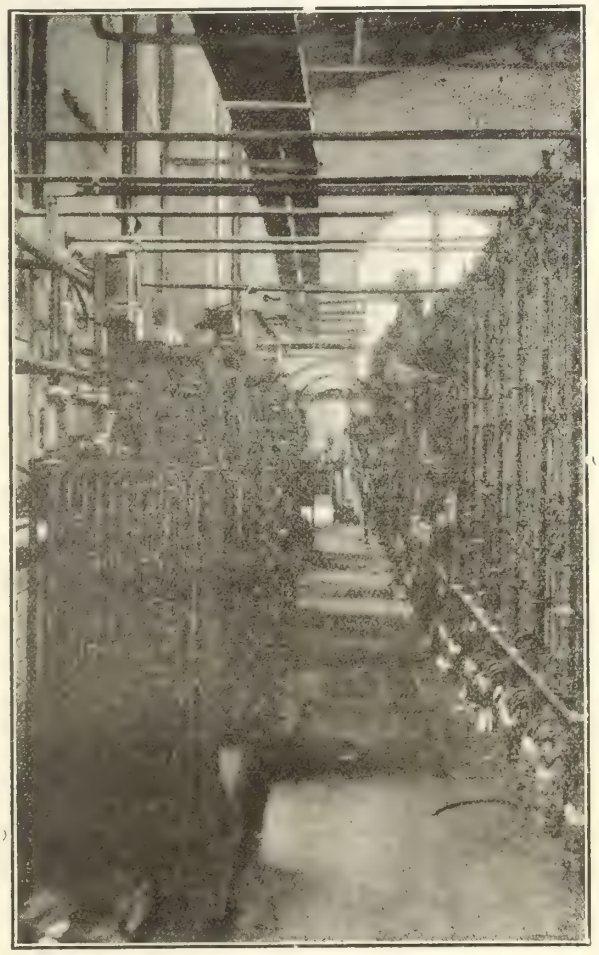


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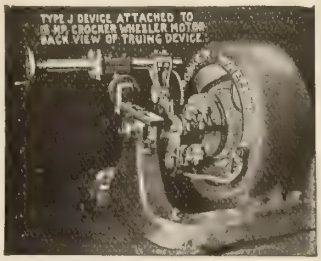
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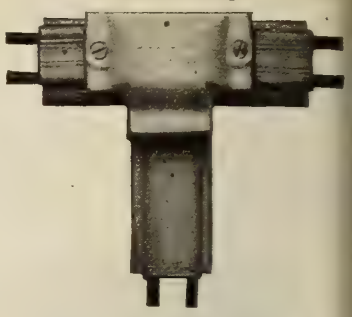
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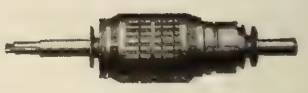
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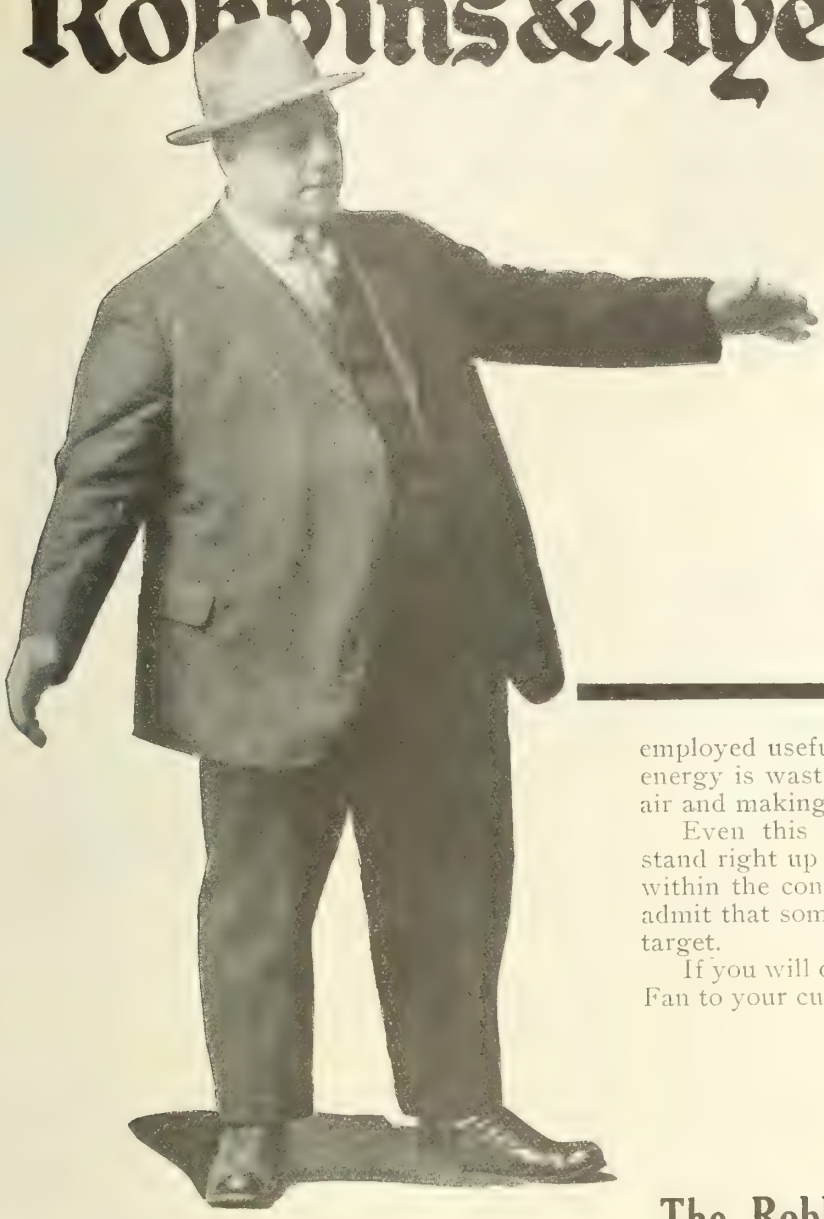
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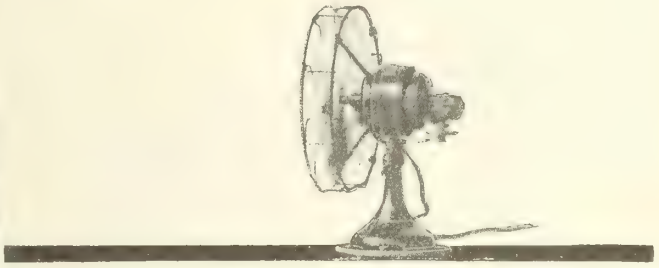
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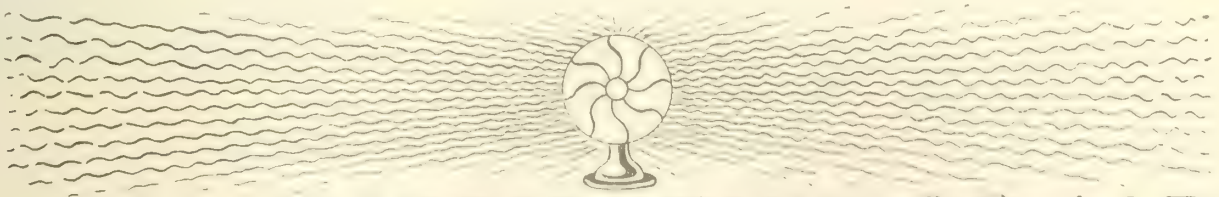
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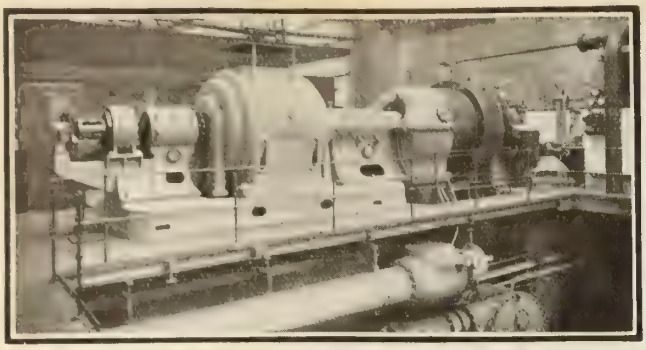
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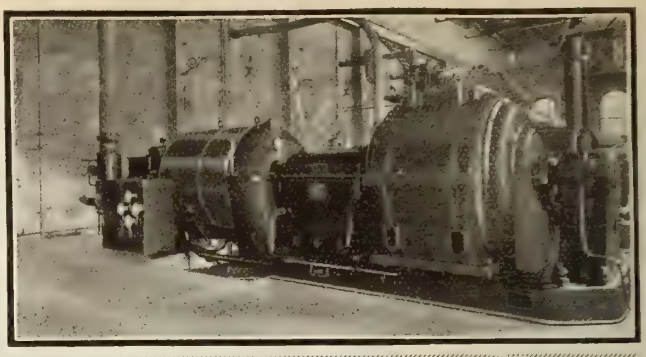
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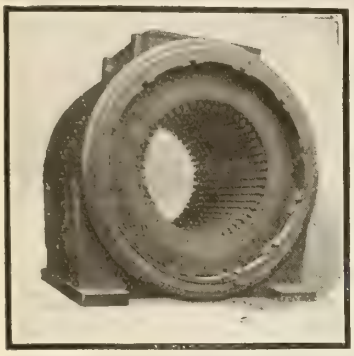
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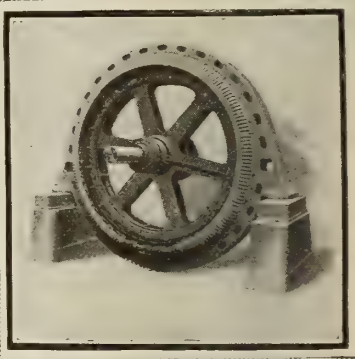


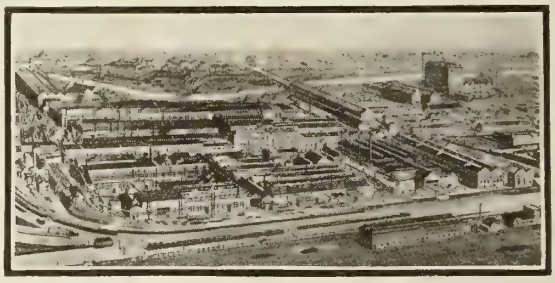


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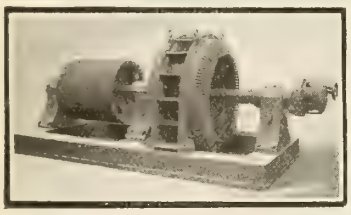
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Generation, Transmission and Application of Electricity

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Vol. 27 Toronto, April 15, 1918 No. 8

Government Acting on Recommendations of Advisory Council

Several months ago the Advisory Council for Industrial Research made an investigation through a sub-committee, of which Mr. R. A. Ross, consulting engineer, Montreal, was chairman, of the possibility of utilizing the coal fields of Central Western Canada at other points than the immediate vicinity of the coal fields. Although the areas in this portion of Canada are almost entirely underlaid with coal, it is unfortunate that this is of a composition which deteriorates rapidly after mining, and so is not suitable for shipment to any great distance either east or west. It is doubtful if any Alberta coal, for example, has reached farther east than Winnipeg, and, therefore, it is readily seen that the Alberta coal, in its natural state, cannot be utilized to relieve the fuel shortage in what Mr. Challies designated in his recent paper before the Canadian Society of Civil Engineers as "The Acute Fuel Area," lying, roughly, east of Regina and west of Quebec.

The result of the investigations of Mr. Ross' committee showed the possibilities of briquetting this unstable coal into a more permanent form and suitable for shipment to much greater distances. As a result of these investigations, therefore, the Advisory Council made a recommendation to the government that a sum of $400,000 should be expended on the erection of a briquetting plant.

It is no secret that the members of the Advisory Council and other engineering bodies were keenly disappointed that the government did not see its way at that time to carry out these recommendations. That, however, was during the summer of 1917, and before we had experienced the acute coal situation which has existed during the past three or four months. As a result of this new experience, however, the government has now announced that they are prepared to go ahead with this plant and that the sum of $400,000 is being placed in the estimates for that purpose. There can be no doubt that in this matter they are acting most wisely and that the course they are pursuing will receive the support of all sections of the country.

Quebec Water Powers Before Montreal Electric Club

Speaking on the water-power development of Canada in relation to the fuel situation at a meeting of the Westmount Canadian Club on April 3, Mr. A. B. Beale, of the Water-Powers Branch of the Department of the Interior, urged the use of every possible substitute in order to reduce Canada's dependence on the United States for fuel. The greater use of water-power, he said, was one of the solutions of the problems, especially the generation of energy for industrial purposes, since it gave a much more economical return for the power developed than coal could possibly do. The substitution of water-power for coal would also greatly reduce the strain on transportation systems. Another advantage was that the water-power was practically unlimited, there being no diminution as the power was developed, as was the case with other sources of power.

Canada had, roughly speaking, eighteen million horse-power of hydro-electric force available within areas either already populated or likely to be so within a short time. Of this only one-tenth had as yet been developed, 75 per cent. of which was being used for municipal or other ordinary uses, 15 per cent. for pulp and paper mills, and the balance for other industries.

Practically every large centre in Canada, except some in the Middle West, was within reach of hydro-electric power, and he looked for a steady development of this source of national wealth. As to the electrification of railways, it might come later, but there would have to be a greater frequency of service, with lighter trains, to make it practical. He looked, however, for an increase in ordinary rail traffic, with a growing use of electricity for traffic purposes at terminals, and eventually an increase in the general use of electric traction.

The address was illustrated by a number of views of water-powers in the Province of Quebec, together with views of plants, transmission lines, etc.

Out of the Frying Pan Into the Fire

Apparently as a means towards mitigating the fuel shortage from which Central Canada suffered so greatly during the past winter, and which resulted not only in great personal inconvenience, but also in the shutting down of many of our vital industries, the fuel controller has seen fit to issue an order to the effect that householders and others who lay in a stock of coal for the coming winter can only purchase up to 70 per cent. of last year's requirements. As a result, when the companies are approached for an advance supply of coal, the customer is asked: "How many tons did you use last year?" If his answer is, say, "Twenty tons," he is booked for fourteen tons, and this amount will be supplied as soon as incoming shipments make its distribution possible.

It is difficult to understand what the fuel controller expects to gain by this procedure. Under the circumstances which existed last winter there were few establishments that consumed more fuel than was absolutely necessary, and in many cases a reduction of 30 per cent. would simply mean that the plants or homes will have to be closed up. If the circumstances which existed last winter, when a considerable percentage of our people had supplied themselves beforehand with their full requirements, and it remained only for the various dealers to supply the less provident proportion of

[illegible] if, under these circumstances, the supply of coal is inadequate, how much greater will the problem of supply be next winter, when there will be, in addition, the 30 per cent. of the demand of the forehanded customers also to be brought in and delivered.

It is possible the fuel controller may have argued that if the customers who usually lay in their supply beforehand are not allowed their full quota this might induce a considerable percentage of the improvident customers to buy ahead. This is very doubtful, however. The situation was sufficiently threatening last summer to induce anyone who was so inclined, or who had the ready money, to lay in such stock as he required, and it seems entirely unlikely that a greater number will avail themselves of this opportunity during the present summer. The fuel controller's order apparently, therefore, seems to mean simply this: that the dealers who in the past have urged their customers to take summer delivery because it is, so to speak, an "off peak" period, will be forced in a greater degree than ever during the present summer to keep their staff and their distribution forces in idleness.

This is, undoubtedly, the way the fuel controller's order appeals to the average person. It is also, so far as we can learn, the interpretation put upon the situation by the dealers themselves. If the controller has any other interp etation of this un-understandable order he has failed, unfortunately, to take the public into his confidence.

Professional Meeting to Discuss Fuel Situation

In this issue we are reproducing a number of papers dealing with the fuel situation, and more particularly the relation between electricity and the relief of the fuel shortage, presented before the recent professional convention of the Canadian Society of Civil Engineers, held in Toronto. Although there may have been no great amount of new information brought forward in these papers, yet the conference is notable, in that it indicated the interest professional engineers are taking in the situation, and at the same time showed that they were in possession of all the knowledge necessary to supply a solution of the difficulties under which we have labored during the past winter so far as it is available.

The conference, unfortunately, was not able to prove that electricity can compete, in dollars and cents, with coal as a source of heat supply. The figures that were given merely corroborated previous statements, that electricity must be available in very large quantities, at a price anywhere from 1/4 to 1/5c per kilowatt-hour, before electric heating will be as cheap as the present coal furnace. Not only does electric heating cost more, but there is not sufficient electric energy available to supply the general needs of the people of Canada. Immediate relief, therefore, must come from some other source, and in this respect wood was recommended as the most easily available, and, after that, peat. The latter fuel, however, could not be available until the winter of 1919, so that all the relief we can expect for the coming winter must be in the nature of a wood supply. During the conference it was announced by a representative of the Ontario Government that all provincial buildings would be supplied during the coming winter at least in so far as was possible by wood cut from Algonquin Park. What the price will be has not, of course, been determined, but it is not likely that even here, where the fuel will be obtained for nothing, that its price, laid down in Toronto, will compare with coal.

The conference was also of interest in that considerable light was thrown upon the possibilities of general electrification of railways. In this connection it was shown that while this is an end to be worked for—and, we trust, ultimately obtained—there is no immediate prospect that the coal situation can be relieved during the next two or three years by electrifying the railways of the Province of Ontario in any except isolated cases. When conditions arrive that such electrification is possible, the fuel saving, of course, on account of the inefficiency at which steam railway engines operate, will be very great.

The papers constituted a record of information which will be found of great value to readers of the Electrical News. Such as we have space for will be found in this issue, and all other papers having a direct bearing upon the relation of electricity to the fuel question will be published later.

Teach the Children That a Line Wire "Kills"

A correspondent sends the following suggestions:

"Sidney G. Booth, a boy 14 years of age, while returning from school on Wednesday, March 20, discovered, or was attracted by, the flash when a 6,000-volt wire of the Cataract Electric Company broke. He went to the wire, which was dangling in the air, and in some mysterious way he spliced a short piece of wire on to the live wire, and upon stepping from the snowbank to the ground was electrocuted.

"Would it not assist in stopping people from touching live wires if the legislature put through an act prohibiting any person from lifting a wire in his hands unless equipped with rubber gloves, or unless a stick were used in handling the wire? The public never seem to learn that they cannot let go of a live wire when once gripped by the hand unless the wire is overhead and their own weight pulls them free, or they are thrown to the ground. The public school Second Reader should contain some instructions and warnings to be taught by the teachers as a guidance to the children. Every child would be thereby warned and cautioned at the earliest possible age, and at a time when inquisitiveness begins to make an appearance. Electricity is coming into such general use, both in the cities and in the country that the death-rate from such accidents is something appalling. It is up to our legislators to do all within their power to safeguard the public, bearing in mind that the child of to-day is the man of to-morrow and the lessons taught to-day will bear fruit in after years."

There is no doubt that every possible effort should be made to educate the public that electric wires are to be avoided under any circumstances, and especially when they are dangling near the ground. It is not quite plain, however, how any act of the legislature could prevent such an accident as that recorded above. In the first place, the boy would be ignorant of the law, and, in the second place, he paid the price of his own mistake so effectively as to place him beyond the punishment of the law. The only way seems to be to train children up in the belief that a dangling wire will "kill." This being the case, the proper place to educate them seems to be in the schoolroom, as our correspondent suggests. A certain amount of education in this direction might well form a small part of the public school curriculum. Perhaps our correspondent has not seen the splendid safety pamphlets being issued by the Ontario Safety League, and which are supplied on request for distribution among the school children. These are valuable assistants in the campaign, and should be used freely, supplemented, of course, by school and home admonitions.

The contract for the dam and concrete power house of the new development of the Southern Canada Power Company on the St. Francis River at Drummondville, P.Q., has been let to Morrow & Beatty, Ltd., Peterboro. It is proposed to develop 10,000 h.p., but provision is being made in the power house for ultimate development of 18,000 h.p. The work will include about 80 miles of new transmission lines, for linking up parts of the system.

Canada's Water Powers and Their Relation to the Fuel Situation

By Mr. J. B. Challies*

The subject assigned to me in connection with this fuel-power symposium meeting of the Canadian Society of Civil Engineers is the relation of water-power to the fuel situation in Canada. At first "blush" it might appear that water-power has only an indirect and limited connection with the recent critical fuel shortage which, through suspended effort, has caused temporary industrial stagnation and local domestic hardships of enormous extent and involving great financial loss Even a casual general survey of our fuel-power requirements, however, will indicate that not only has water-power a very direct and important bearing on the present situation. but that water-power must, in the future, take a very much greater share in our fuel-power burdens.

Heat, Light, and Power Needs—One Problem

It is axiomatic that our heat, light, and power needs must be considered as one great national problem, and also that Canada's domestic and industrial development depends primarily on the co-ordinated use of all the fuel-power resources of the Dominion.

Development along independent and divergent lines has, in the past, prevented adequate correlation of the great Canadian industries of fuel production and hydro-power supply. There is now, however, as a result of the fuel shortage, developed a concensus of opinion among men familiar with fuel and hydro-power matters in Canada that there is between these allied industries enormous scope for national co-operation which would be conducive to their mutual advantage, as well as to the common weal. I propose to show:

First—That water-power must take a very prominent part if the best use of the varied fuel-power resources of Canada is to be achieved; and

Second—That there must be evolved a national master fuel-power policy which will realize the best possible co-ordinated and concomitant development and use of all the fuel-power resources of the Dominion.

Interdependence of Water-Power, Coal, Wood, Peat, Oil and Gas

Within the last two days we have had recognized experts describe the possibilities and proper functions of our different available fuels—coal, wood, peat, oil, and gas. Practically every speaker has indicated their interdependence and their interchangeability of use. It remains for me to demonstrate the relation of "white" coal to all other fuel-power agencies, and to point out that they must all "coalesce" in meeting the fuel-power requirements of the country.

To furnish a quick general summary "bird's-eye view" of the "white" and black coal situation in Canada, and to indicate their integrity I have had several maps and diagrammatic statements specially prepared for submission at this meeting.

Pacific and Atlantic Provinces Self-Sustaining, but Central Provinces Dependent for Coal

Plate No. 1 represents the coal consumption and production in Canada. The tabulated statement on the top of the

* Superintendent Dominion Water Power Branch, Department of the Interior, Ottawa, Ont., before Professional Meeting C. S. C. E.

SOURCES OF DATA	CONSUMPTION	BRITISH COLUMBIA	ALBERTA	SASKATCHEWAN	MANITOBA	ONTARIO	QUEBEC	PRINCE EDWARD ID	NEW BRUNSWICK	NOVA SCOTIA	GRAND TOTALS	REMARKS
This data obtained from. Alberta. Dept. of Public Works, Annual Report, 1916. Albert. Dept of Mines, Quarterly Bulletin, 1917. British Columbia. Bureau of Mines, Annual Report, 1916. Canada. Dept of Mines, Mines Branch, Production of Coal & Coke in Canada, 1916. Canada. Dept. of Customs, Annual Report, 1915-16. New Brunswick. Crown Land Dept., Annual Report, 1915-16. Nova Scotia. Dept. of Public Works and Mines, Annual Report of the Mines, 1915-16. U.S.Geological Survey, The Coal Fields of the United States, 1917. (Professional Paper 100-A) U.S.Geological Survey, Coal in 1915 Part A, Production; (Part B, Distribution and Consumption, 1916.	Domestic											This compilation is based on two figures "consumption areas between adjacent districts because [illegible] town, or suburb of the consumption is railway coal and as such is carried from province to province as traffic necessitates
	Anthracite	10,544 (2)	113,130 (2)	28,197 (2)	1,658 (3)	—	—	—	—	—		Tonnages 1) Are from Mines and other reports of provinces concerned. 2 Are from combinations of reports of provinces concerned 3. Are coal plated, allocating the tonnage according to population and known consumption, both imported and domestic, deductions and additions being made accordingly for domestic and imported tonnages in order to arrive at a reasonable figure. These figures cannot be obtained direct from any Government report
	Bituminous	1311,433 (2)	1951,833 (2)	140,413 (2)	17,719 (3)	—	994,944 (1)	82,924 (1)	891,031 (1)	2,826,300 (1)		
	Lignites	21,143 (2)	959,526 (2)	1,134,346 (2)	79,252 (3)	—	—	—	—	—		
	Total Domestic	1,343,120	3,024,489	1,302,956	98,629	—	994,944	82,924	891,031	2,826,300	10,701,530	
	Imported											
	Anthracite	—	Small	208,000 (3)	325,000 (3)	2,242,874 (3)	1,794,410 (3)	—	Small	Small		
	Bituminous	—	Small	718,879 (3)	1,627,998 (3)	6,459,105 (3)	4,174,850 (3)	—	—	—		
	Total Imported	—	Small	926,879	1,952,998	8,701,979	5,969,260	—	Small	Small	17,580,603	
	Total Consumption	1,343,120	3,024,489	2,229,835	2,051,627	8,701,979	6,964,204	82,924	891,031	2,826,300	28,282,133	Differences in totals are accounted for partly by taking arbitrary figures in some cases for purposes of calculation and by different methods of tabulation and statistics
	Total Production	2,584,061	4,559,054	281,300	—	—	—	—	143,540	6,912,140	14,480,095	
	Production over consumption	1,240,941	1,534,565	—	—	—	—	—	—	4,085,840		
	Consumption over production	—	—	1,948,535	—	—	—	—	747,491	—		
	Consumption no production	-	—	—	2051,627	8,701,979	6,964,204	82,924	—	—		
		BRITISH COLUMBIA	ALBERTA	SASKATCHEWAN	MANITOBA	ONTARIO	QUEBEC	PRINCE EDWARD ID	NEW BRUNSWICK	NOVA SCOTIA		

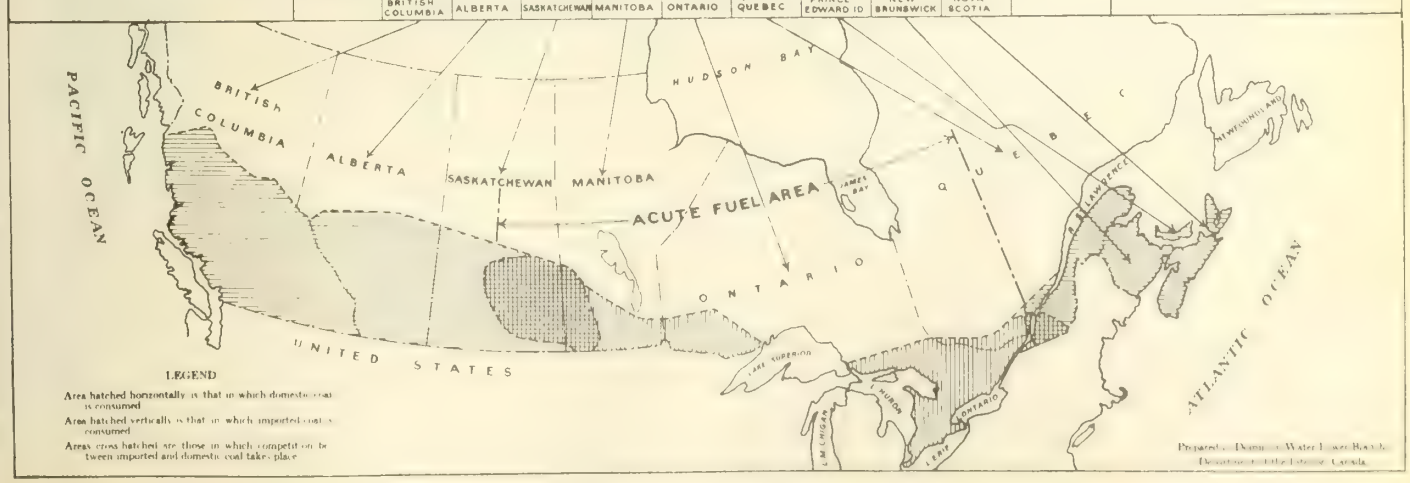


Plate No. 1—Note Acute Fuel Area.

plate summarizes the consumption in the various provinces of the different classes of coals, both domestic and imported. You will observe the greatest consumption is in Central Canada, including the Provinces of Manitoba, Ontario, and Quebec. Coal production is greatest in the extreme western and eastern provinces. British Columbia and Alberta, on the one hand, and Nova Scotia, on the other, not only meet their own coal requirements, but produce a very considerable overplus for consumption in the contiguous portions of Central Canada. The central provinces—Manitoba, Ontario, and Quebec—are almost wholly dependent on outside sources; mainly imported coals. This is clearly shown by the hatched areas on the map, the horizontal hatching covering the areas which produce their own needs, the vertical hatching covering the areas which are dependent. Where there is cross-hatching, both Canadian and imported coals are consumed. It is to be observed that Central Canada, where consumption is greatest, is non-productive. This I have termed the "acute fuel area" of Canada.

An Acute Fuel Area in Canada Largely Dependent on Imported Coal

This "acute fuel area" is now dependent for domestic requirements mainly upon Pennsylvania anthracite and for industrial needs upon Pennsylvania bituminous coals, as well as upon Canadian water-power. So far as domestic heating requirements are concerned, Mr. Dick, the consulting mining engineer of the Conservation Commission, in his paper on the "Rational Development of Canadian Coal Resources," has pointed out the possibilities of the western portion of the "acute fuel area" being furnished with briquetted lignite from the prairie provinces. Mr. Stansfield, of the Dominion Mines Branch, in his paper on "The Low Temperature Carbonization and Briquetting of Bituminous Coal." has pointed out the possibilities of meeting the domestic heating requirements of the eastern portion of the "acute fuel area" by the product from the low temperature carbonization of Nova Scotia bituminous coals. Although both these processes are proven to be practicable, they are as yet in their formative or agitational stage, and some considerable time must elapse before they can be placed on a commercial basis to furnish sufficient fuel to substitute for any large portion of the Pennsylvania anthracite now imported for domestic heating. There is at the present time no available supply, even in small quantities, of a Canadian coal fuel to take the place of imported anthracite. Nevertheless, this "acute fuel area" can eventually be made independent of foreign fuel imports, and Canada can become self-sustaining, at any rate, in respect of her domestic heating requirements. There must, as a necessary preliminary, be a national, co-ordinated development and use of all the available fuel and power-producing agencies in the Dominion. Such a co-ordination must be a matter of gradual evolution and adoption, and will, to a great extent hinge on whether Canada can reasonably expect assured fuel, imports from the United States for a considerable period in the future.

Canada an Exporter of Electrical Energy

As we are now exporting large quantities of coals from British Columbia and Nova Scotia into adjacent states of the Union, and as we are also exporting about 275,000 horsepower of electric energy, equal in value to about 3,000,000 tons of coal, it is obvious the United States cannot afford to place a sudden and complete embargo on coal exportation to Canada. The two countries must deal with each other, at least, upon a basis of quid pro quo. Providing Canada has her own fuel resources under strict national control, this power exportation should assure her an importation of sufficient coal to tide over any readjustment period necessary to permit of an ultimate dependence on Canadian sources of fuel and power.

Exportation of Electrical Energy and Assurance for Fuel Needs

The exportation in the past of Canadian electric energy has not been without compensating advantages. An assured United States market for Canadian power loads has enabled the financing and completion of several hydro-electric projects, the construction of which, so far as domestic markets alone are concerned, would not have been warranted at the time. The initial United States power load has, therefore, made it possible for the domestic market to reap all the bene-

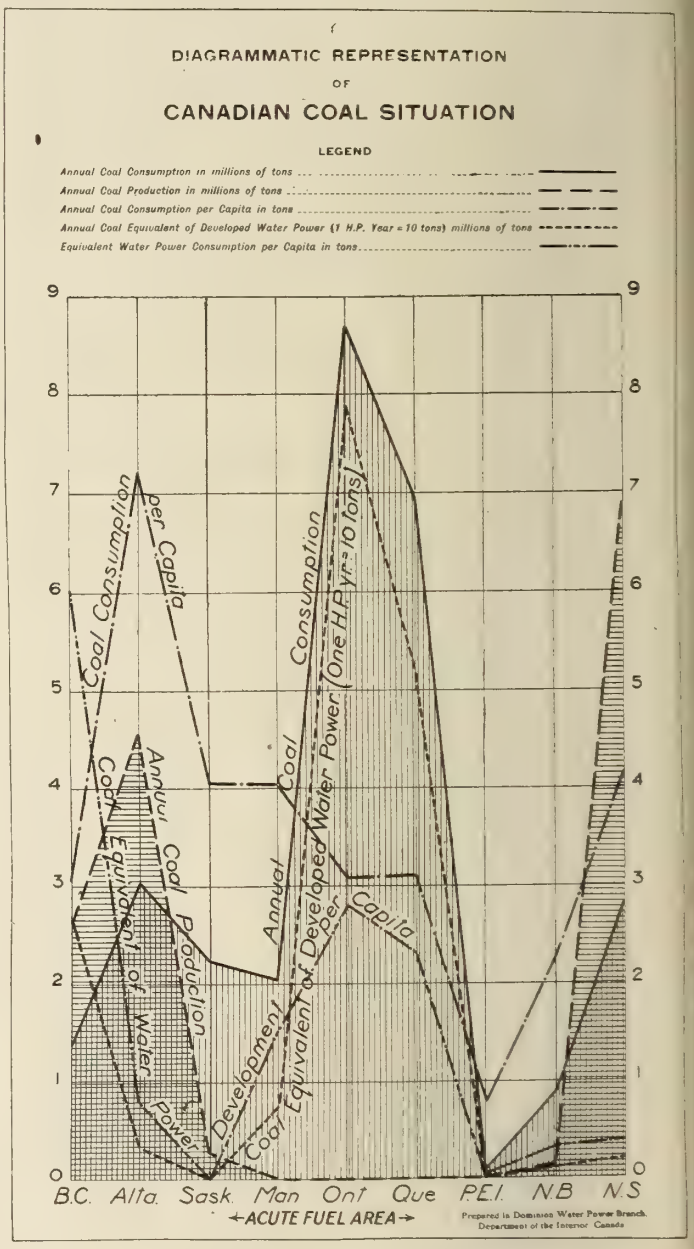


Plate No. 2—Canadian coal situation.

fits of available hydro-electric energy many years sooner than otherwise would have been possible.

While Canada has been receiving far more value in her coal importation than she has given in her power exportation, the advantage is rapidly disappearing. It is reasonble to expect that the tendency will be for hydro-power exportation to increase and for coal importation to decrease. The time may come, and in the near future, when the balance will be against Canada.

It is, therefore, imperative that every proposal for increase in the exportation of power be carefully considered from a broad, national standpoint Such consideration in-

volves the evolution of a formula with regard to power exportations which will have cognizance of Canada's fuel-power needs generally.

We must face the fact that for some time to come we shall require to import United States coal, and that in turn therefor we can, under proper conditions of recovery, safely and profitably export some of our surplus hydro-electric energy.

Canada, to Become Self-Sustaining, Must Use All Her Fuel-Power Resources According to Their Particular Adaptabiliity

Mr. B. F. Haanel, chief of the Fuel Testing Division, Department of Mines, in his clear and comprehensive paper on the "Fuels of Canada," describes the nature, location, and extent of our varied available fuel resources. Mr. Haanel affirms that, while the problems associated with the distribution of fuel to the various parts of Canada are exceedingly complex and the strictest conservation must be practised, the Dominion is endowed with fuel deposits on such a magnificent scale that all that is necessary is their proper exploitation and economic use for the country to be eventually practically independent of foreign sources of fuel. Mr. Haanel is particularly emphatic that Canada need not go abroad for fuel for household use, if her own fuel resources are properly exploited.

The problem of Canada's fuel needs outside of the "acute fuel area" offers little difficulty, owing to an abundance of both coal and water-power. It is simply a matter of efficient and effective use of available resources. Within the "acute fuel area," however, the problem is pressing and prodigious. It resolves itself into two parts—first, provision for domestic or household heating consumption; second, provision for industrial requirements.

Domestic Requirements

1. Domestic requirements of "acute fuel area" involves production of suitable substitute for anthracite.

Domestic needs involves the production of a fuel or fuels which will meet the requirements for general household use. At the present time this need is furnished by American anthracite; over 4,000,000 tons were used in 1916. Competent experts declare the anthracite coal fields of the United States are in measurable distance of exhaustion, and that the supply will not last a hundred years. Having in mind the ever-increasing demands within their own borders for this fuel, and the rapid decrease in quality as the supply becomes exhausted, responsible fuel advisers of the United States Government have seriously urged the establishment of an embargo against exportation of anthracite. We in Canada must realize that our supply of this fuel may be gradually restricted. It is, therefore, essential that we, without delay, consider what can be accomplished in the production of a suitable substitute for United States anthracite.

Industrial Requirements

2. Industrial requirements of "acute fuel area" involves (a) more efficient use of soft coal in central heating stations; (b) construction of super-power plants to serve contiguous industrial areas; (c) substitution of hydro-power for steam-produced power wherever possible; (d) use of hydro-power for all new industries wherever practicable.

The second part of the "acute fuel area" problem and the one with which water-power is most intimately connected is the fuel necessity of the industrial or manufacturing world.

The industrial requirements are now met by Canadian hydro power and United States bituminous coal—about 14,000,000 tons consumed in 1916 for this purpose in the "acute fuel area."

Owing to the large reserves of bituminous coal in Pennsylvania, this class of fuel will probably be available to the "acute fuel area" of Canada for many years. Although not immediately necessary, the ultimate substitution of bituminous coals must nevertheless be seriously considered. Water-power will be the main means of such substitution. The industrial fuel problem, therefore, in the "acute fuel area" becomes largely a matter of substitution of hydro power for fuel power.

Electrification of railways—especially terminals with adjacent engine divisions—would save enormous consumption of bituminous coal and relieve our transportation systems of their greatest burden.

It is estimated that something like 9,000,000 tons of coal was consumed by our railroads in the year 1917. Judging from the results obtained from the electrical operation of railroads in the United States, it would be possible to save at least two-thirds of this coal if electric locomotives were substituted for the present steam locomotives. This would be a saving of 6,000,000 tons of coal in one year, and would require about 900,000 water horse-power.

Electrification of steam roads at this juncture is not advocated. Under normal conditions, however, and in certain districts, as in Western Ontario, electrification will become an economic necessity in a few years.

In districts that cannot be served by water-power, the location of modern, efficient, super-power stations at strategic points, with a resultant elimination, or combination, of many

Country	Area Sq. miles.	Population latest available figures.	H.P.Available	H.P.Developed	Per cent utilized	H.P.Available per sq.mi.	H.P.Developed per sq.mi.	H.P.Per Capita Available	H.P.Per Capita Developed
U.S.A.	2,973,890	98,783,300	28,100,000	7,000,000	24.9	9.4	2.35	0.28	0.071
Canada "A"	2,000,000	8,033,500	18,803,000	1,735,000	9.2	9.4	0.87	2.34	0.216
Canada "B" Populated	927,800	8,000,000	8,094,000	1,725,000	21.3	8.7	1.86	1.01	0.216
Austria-Hungary	261,260	51,173,600	6,460,000	566,000	8.8	24.8	2.17	0.13	0.011
France	207,500	39,601,500	5,587,000	1,100,000	11.6	26.8	3.14	0.14	0.016
Norway	124,130	2,391,780	5,500,000	1,120,000	20.4	44.3	9.02	2.30	0.468
Spain	190,401	19,588,700	5,000,000	440,000	8.8	26.3	2.31	0.26	0.022
Sweden	172,960	5,522,400	4,500,000	704,500	15.6	26.0	4.08	0.81	0.127
Italy	91,400	28,601,000	4,000,000	976,300	24.4	43.8	10.7	0.14	0.034
Switzerland	15,976	3,781,500	2,000,000	511,000	25.5	125.2	32.0	0.53	0.135
Germany	208,800	64,926,000	1,425,000	618,100	43.4	6.8	2.96	0.02	0.010
Great Britain	88,729	40,831,400	963,000	80,000	8.3	10.9	0.91	0.02	0.002

"A" excludes Yukon and Northern Area improbable of immediate development. "B" included in "A" is area actually settled.

Plate No. 3—Water powers in Europe and North America—Dominion Water Power Branch estimate, slightly revised.

efficient small stations, would cause a very large saving in the consumption of soft coal, with a concurrent increased production of power.

The substitution in industry generally of hydro power for steam fuel power would also result in a tremendous relief. There are many plants where such an exchange would be possible now. Future manufacturing plants should be encouraged to locate where hydro power is available.

Water-power must be depended upon very largely to serve the industrial fuel-power situation in the "acute fuel area" of Canada.

The relation between developed water-power and the coal production and consumption in the various provinces is represented on Plate 2. It is interesting to note that in the "acute fuel area" there is about as much water-power developed, so far as coal value is concerned, as there is coal consumed. It is portentious that the bulk of our water-power production at the present time is within the "acute fuel area," and it is reassuring to know that our largest and most important potential water-powers are located within transmission range of present congested industrial districts within the "acute fuel area."

Canada Is Exceedingly Fortunate in the Extent and Location of Her Water-Powers

When considered in retrospect the production of hydro power in Canada has undoubtedly been an industrial achievement and an engineering triumph worthy our nation. In the short space of about twenty-five years there has been developed and put in use nearly 1,800,000 water horse-power. A tabulated statement (see Plate No. 3) of the water-power development in other countries, compiled recently from all available data, shows the universal importance of this resource, and indicates the splendid comparative position Canada enjoys in both potential and developed water-power. The present per capita power development in Canada is larger than all other countries except Norway. It is the same with respect to our known undeveloped water-power. No country enjoys to a greater degree the benefits of cheap dependable hydro power, and no country has had these benefits more universally applied for municipal, industrial, and domestic use. That Canada is recognized as one of the great water-power countries in the world is due largely to:

1. The nature and extent of our water resources—abundance and seasonable distribution of rainfall; the regimen of our rivers—upper waters well forested with large lakes, suitable for regulation, rivers flowing through valleys with well-concentrated falls.

2. The fortunate location of the waterfalls with respect to existing commercial centres and related raw materials.

3. The consistent endeavors of governments, Dominion and provincial, in having water-powers thoroughly investigated and intelligently administered.

4. The business acumen and foresight of the capitalist and the professional skill and courage of the engineer in blazing the trail of pioneer water-power development and use.

5. The almost universal adaptation of electric energy for municipal, industrial, and domestic purposes.

Fortunate Location of Water-Powers

The outstanding feature of the water-powers of Canada is their fortunate location with respect to existing commercial centres. Within economic transmission range of practically every important city from the Atlantic to the Pacific, except those in the Central Western prairies, there are clustered water-power sites, which will meet the probable demands for hydro power for generations. The following table, prepared by the Dominion Water-Power Branch, indicates, reasonably accurately, the provincial distribution of the developed and undeveloped water-powers within the settled portions of the Dominion:

Province.	Power available.	Power developed.
Ontario	5,800,000	789,466
Quebec	6,000,000	520,000
Nova Scotia	100,000	21,412
New Brunswick	300,000	13,390
Prince Edward Island	3,000	500
Manitoba		76,250
Saskatchewan	3,500,000	100
Alberta		32,860
British Columbia	3,000,000	269,620
Yukon	100,000	12,000
Totals	18,803,000	1.735,598

Small Portion, Not 10 Per Cent, of Canada's Available Water-Powers Developed

In general, the use of water-power in Canada may be briefly described as follows:

(a) For municipal, including domestic and ordinary in-

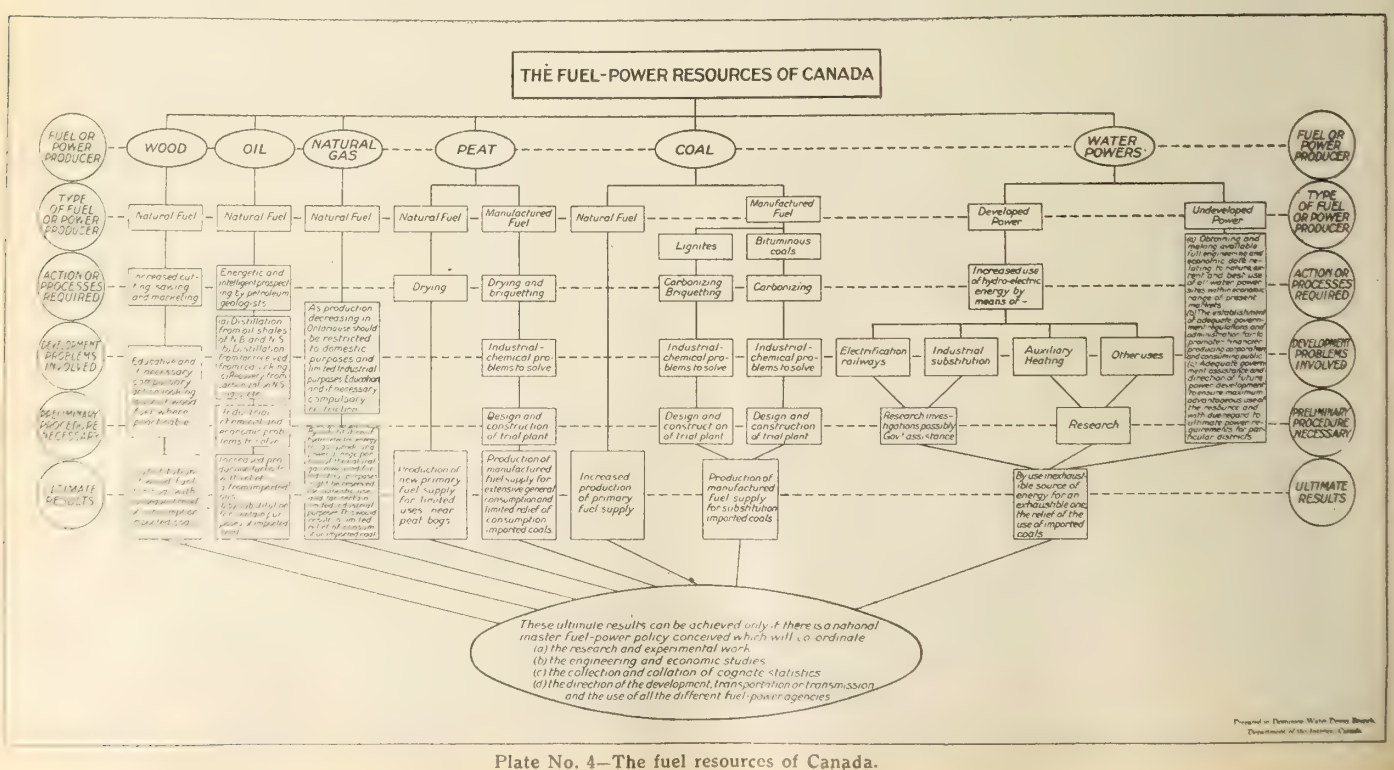


Plate No. 4—The fuel resources of Canada.

dustrial purposes, about 78 per cent. of total developed, or 1,348,490 h.p. So far as these uses are concerned, further requirements will probably be met for some years by additional installations at and increased storage for existing plants. In certain centres, however, as, for instance, the Niagara power zone, growing requirements can only be met by new water-power developments.

(b) Pulp and paper, about 14 per cent. of total developed. or 248,075 h.p. Further pulp and paper plant requirements can probably be met for some time by additional installations to present plants, although the tremendous growth of this industry will necessitate the development of new water-powers in different parts of the Dominion. There are now 54 pulp and paper plants scattered throughout Canada, and several new plants have been under serious contemplation, some of which would be in use now had it not been for the difficulty of financing, due to war conditions. On account of the isolated nature of the industry—away from commercial centres—power requirements for pulp and paper need not conflict with other demands upon hydro power.

(c) Electro-chemical and similar processes, about 8 per cent. of total developed, or 140,000 h.p. While the United States have achieved almost a world-supremacy in electro-chemistry, this industry in Canada is of very recent growth. It has, however, expanded at an enormous rate, entailing recent extensive additional installation in present plants, and requiring in the near future the development of additional water-power sites. Our propinquity to the United States and our abundance of essential raw material will compel the migration to the Dominion of many new electro-chemical plants of importance and value.

The products of the electro-chemical industry are extremely diversified. They include aluminum, silicon, calcium-carbide, cyanimid, ferro-alloys, graphite, carborundum, chlorine, etc., many of which are indispensable in the arts and in manufacture. Without aluminum the modern high-speed scout airplane would not exist; without electro-chemical abrasives and ferro-alloys manufacturing processes would be lengthened many fold.

One of the most important electro-chemical processes is the fixation of nitrogen. About 30,000 h.p. is used for this purpose at Niagara by the American Cyanamid Company, and, while other plants of this kind have so far not been put into operation commercially in this country, they have been seriously contemplated, and await only a sufficient source of low-price power for realization.

The electro-metallurgical industry is in its infancy, but promises great expansion, especially in the production of nicu-steel in Canada. Few people appreciate the rapid growth during the last few years in the use of electric furnaces for the production of the highest grades of steel.

By proper foresight the demand for hydro power for these industries need not conflict with other demands, as, for instance, municipal, domestic. and ordinary industrial uses.

Total developed power about 1,735,598 h.p.

Further Use of Hydro-Electric Power

In considering the future of water-power development in Canada it is important to note that it means the use of a non-expendiple resource, and in many cases represents the substitution of an inexhaustible resource for an exhaustible one. For this reason the use of hydro-electric energy should be encouraged in every reasonable way.

Further development of water-power in Canada will, undoubtedly, be extensive, and must depend very largely on:

1. Additional requirements for municipla, industrial, and domestic use.

2. Growth of pulp and paper industry.

3. New electro-chemical and electro-metallurgical processes.

4. Electrification of steam roads, especially terminals and adjacent engine divisions.

5. Substitution of hydro-electric power for fuel-power in manufacturing and industry.

In the rapid development within a short space of time of our water-powers to the extent of nearly 1,800,000 horse-power it is natural to expect that there has been some misconception in design. in construction, in conservation of opportunity, in overlapping of service, and even in governmental administration, although as to the latter it is an axiom in British jurisprudence that "the king can do no wrong." If we were starting de novo to develop our water-powers, with our present knowledge of what is essential in government investigation and administration, of what is really basic in conservation of resource, of the present practice of the art of hydraulic and electric engineering, and last, but by no means least, of what is the most important or prior market demand, from a national standpoint, from particular power sites, whether general municipal requirements should precede electro-chemical and allied industrial requirements, we would. for instance, most assuredly produce a very different power situation at Niagara. At the same time this most important and world-famous source of our electric energy has well served us. Generally speaking, our water-powers have undoubtedly proven to be one of Canada's most valuable assets.

Looking to the future in power development, if Canada is to reap full benefit from her heritage in white coal, there must be a constructive liaison between:

(a) The various Dominion and provincial government administrative departments concerned in water-power matters.

(b) The producing corporation or commision; and

(c) The consuming public.

Concurrently with such a liaison there must also be an adequate co-ordination of the development and use of water-power with that of all other power-producing agencies.

Anyone who has listened attentively to the very able presentation of the various elements in the fuel situation during the last two days must realize that there is a prodigious field for such co-ordination in the development and use of our varied power and heat-producing resources which will combine the effective use of all along lines for which each is best adapted, and which will, by avoiding duplication or misdirection of effort, promote the efficiency of both individual and conjoint use.

The necessity for the correlated development and use of all our fuel-power resources has surely passed the agitational or educational stage. The many urgent reasons for such correlated use are stressed a hundredfold by the coal shortage experience of this winter.

To visualize the interdependence and interrelation of all the fuel-power agencies available in Canada, and to offer something as a basis for general discussion, I have prepared a chart (Plate No. 4), which, if it indicates any one thing, it conclusively proves the immensity and complexity of the problems involved in effecting the co-ordinated, concomitant development and use of all our fuel-power resources. The chart shows that this can be best realized following the evolution of a national master fuel-power policy for all of Canada.

Gentlemen of the Canadian Society of Civil Engineers, are we going to leave this great problem in "the laps of the gods"? Is it not one of peculiar concern to engineers, and of such timely and pressing importance to Canada that we, as a society, would be warranted in attempting a solution? Should we not mark the enlargement of the scope, influence, and prestige of our society (which we hope is being exemplified by its transition to the Engineering Institute of Canada), by an earnest effort to evolve, in general terms, the basic principles of a national master fuel-power policy for Canada.

Possibilities of Lessening Fuel Consumption by the Adoption of Electrical Heating

By Mr. P. H. Mitchell*

The use of electricity in heating to lessen the fuel consumption can have very little material effect on the situation at the present moment, due mainly to the general economic limitation of available electric power and to the high cost of heating produced electrically as compared with the cost of heating by means of the common fuels.

In the future, and probably in the near future, electricity, from its possible cheapness, its possible sufficient available supply and, further, in some districts from its necessity, due to insufficient supply of combustible fuels, may assume a very important role in the heating field. It is only by electricity developed from water-power that the sufficiently low cost may be attained to make electrical heating feasible.

Canada is blessed with an abundance of water-power and, in some districts, with ample coal deposits. Nova Scotia coal is used in Nova Scotia, New Brunswick, Prince Edward Island, and Quebec; Nicola Valley and Vancouver Island coals are used in British Columbia; Crow's Nest, Lethbridge, and Edmonton coals are used in Alberta and portions of Saskatchewan and Manitoba; Ontario, practically all of Manitoba, and a small part of Quebec are dependent on United States soft coal, and United States anthracite is used over a slightly larger area.

Water-Powers Serve Districts Lacking Coal

In examining the map of Canada, having in mind the distribution of coal areas and water-power areas, it is apparent that the districts not readily served with native coal are the districts most abundantly served with water-powers. From Montreal westward to Manitoba, in the districts supplied by United States coal, the water-powers are destined to be developed to their maximums to serve the industries and utilities of the future.

It does not need much imagination to look forward, say, fifty years, a period which may be within the lifetime of a large number of us. What will be the fuel situation then? Will coal, as normally at present, be available in generous supply? Will the peat and oil sources be meeting any lack of coal? Statistics do not show a promise of this, and in the meantime, if this is "Canada's century," what is the prospect of population? An increase to 25,000,000 people by 1968, I am sure, is a figure well within the expectation of all, and Central Canada's share of this may be 15,000,000, all dwelling in the area now dependent on imported fuel.

Further, our fuel situation is so closely meshed with that of the United States that we must appreciate their viewpoint. Are two hundred millions of population in the United States in 1968 beyond a conservative estimate? Many think not, and with a fuel consumption advancing out of all proportion to increase of population, an economic limit of fuels is in sight. The prospect may result in a most drastic administration of fuels, applying these to heating purposes only, leaving to hydro-electric power all mechanical, railroad, and metallurgical operations in the endeavor to conserve the diminishing supply, and even then such a radical curtailment will only push forward the day when the substitution for fuels must be made.

The fuels of to-day are wood, coal, natural gas, peat, and oil. Of these wood and natural gas are limited for many reasons, and peat is a fuel only by extreme necessity, and as yet is not a commercially accepted probability.

*Consulting Engineer, Toronto, Ont. before Professional Meeting, C.S.C.E

It may be that some genius will conserve and redirect the vast heat transfers of nature to serve mankind, but to-day, in addition to the combustible fuels, we can only add electricity to complete the list of sources of artificial heat.

In all discussion of electrical heating there is one outstanding basis, and that is the thermal value of electricity. One kilowatt hour of electrical energy is equal to 3,413 British thermal units, or one kilowatt hour of electrical energy is capable of raising the temperature of 3,413 pounds of water one degree Fahrenheit. This heating value may be compared with that of other heating sources, and we find that, fundamentally, the ordinary heating mediums, at existing prices, are appreciably cheaper.

For instance, in the comparison of anthracite coal, bituminous coal, peat, oil fuel, and electricity we find:

Comparative B.T.U.'s for 1 Cent

Anthracite coal, in a well-built and well-regulated domestic furnace, is capable of being burned at about 55 per cent. efficiency. A good anthracite contains 13,000 B.t.u.'s per pound. At $8 per ton, 1 cent will purchase 18,000 British thermal units of heat.

Bituminous coal, when burned in a first-class mechanically-stoked boiler installation and distributed for heating purposes, is capable of about 60 per cent. overall efficiency. A good bituminous coal contains 14,000 B.t.u.'s per pound. At $3.50 per ton 1 cent will purchase 48,000 British thermal units of heat.

Peat, in briquet form, with low moisture content, in a properly-arranged furnace, should produce heat available for heating 60 per cent. efficiency on, say, 7,000 B.t.u.'s net available. The industry should be able to approach $4 per ton, so that 1 cent would purchase 21,000 British thermal units of heat.

Fuel oil may burn with 65 per cent. overall efficiency. One pound of the oil obtainable in the local market contains about 18,000 B.t.u.'s. At 7 cents per imperial gallon 1 cent will purchase 15,500 British thermal units of heat.

Electricity, when supplied to well-designed heating equipment, is capable of utilization at 100 per cent. efficiency. One kilowatt hour equals 3,413 B.t.u.'s. With electricity at 1 cent per kilowatt hour 1 cent will purchase 3,413 British thermal units of heat

Or, with electricity purchased at power rates in Ottawa or Toronto, which would average throughout twelve months at 8/10 of 1 cent per kilowatt hour, 1 cent will purchase 4,240 British thermal units of heat.

To-day fuels are more expensive than shown by the above prices, which indicate conditions at more like normal times or what we may expect after the war is over. For instance, in Toronto to-day anthracite will cost $10 per ton, bituminous coal $7.50 per ton, and fuel oil 14 cents per imperial gallon. The cost of electrical power has, unlike almost every other nameable commodity, had a downward tendency, and to-day is generally appreciably lower than before the war.

To recapitulate so that comparison of heating costs may be facilitated, and also showing fuel costs as at present, we find:

One cent will purchase of useable heat:

	B.t.u.'s.
From anthracite at $8 per ton	18,000
From anthracite at $10 per ton	14,300

From bituminous coal at $3.50 per ton	48,000
From bituminous coal at $7 per ton	24,000
From peat at $4 per ton	21,000
From fuel oil at 0.07 per gallon	15,500
From fuel oil at .14 per gallon	7,750
From electricity at 0.01 per kilowatt hour	3,413
From electricity at 0.008 per kilowatt hour	4,240

It must be born in mind that these costs and efficiencies are based on producing heated rooms in buildings, such as dwellings, and that electricity is shown used at 100 per cent. efficiency, assuming it directly applied to the room to be heated, and not affected by the unapplied waste of the other heating systems in chimney, boiler, and transmission losses.

Bituminous coal can only be used in heating plants of some magnitude, and is not suitable for dwellings except by distribution from a central steam plant. Heating by anthracite coal is the source to which electricity is to be compared.

Convenience of Electricity Offsets Extra Capital Charges

It is obvious that the cost of fuel is not the only factor in the cost of heating, but that the cost of heating equipment, attention to fires, disposal of ashes, and even. further, the extra cost of basement for heating equipment, fuel storage, and even the more or less chimneys required, are appreciable items, while fire insurance also plays a part. To go fully into all these items is quite beyond the scope of this paper, but I would propose a well-based assumption that, while the equipment for electrical heating for houses is more expensive than, say, hot air equipment, the greater annual charges against capital costs and for repairs, etc., are more than offset by the greater convenience in the handling of electricity as a heating source rather than coal.

Electricity, to seriously enter the heating field, must. instead of costing 1 cent per kilowatt hour or 1 cent for 3,413 British thermal units, approach 1/5 cent per kilowatt hour, or 1 cent for 17,065 kilowatt hours when it can economically compare with heating by anthracite coal at a fuel cost of 1 cent for 18,000 B.t.u.'s.

Let us consider an electrical heating load in detail. Assume, first, that a house, two storeys and basement, with 600 square feet area on the ground, requires as its maximum here in Toronto a demand of 12 kilowatts. We would find that the use of this throughout the year would be approximately as follows, the load factor being on the maximum demand of the year:

For two months, 12 kilowatts on average 80 per cent. load factor; for two months 12 kilowatts on average 65 per cent. load factor; for two months 12 kilowatts on average 45 per cent. load factor; for two months 12 kilowatts on average 20 per cent. load factor; for four months, 12 kilowatts on average 0 per cent. load factor.

This means a load factor of 35 per cent. over the year, or for eight months, including summer, a load factor of 16.25 per cent. The general use of electricity for heating will involve a scale of millions of horse-power. With the present heating appliances available we cannot expect plants to be built and electricity to be generated for heating purposes only, so we must consider whether we can expect the development of an elastic commercial load of such magnitude that over twelve months of the year a 65 per cent. load factor, the complement of the 35 per cent. heating load factor, can be obtained so as to provide for 24 hours per day and 365 days in the year a 100 per cent. load factor load.

Industrial Demands May Complement Heating Load

It will possibly suffice to answer this by indicating one prospective industry, the electric power demand, of which alone may readily keep pace with the future use of electric heating– that is, the manufacture of nitrogen products for fertilizers. With the depletion of natural fertility artificial fertilizers will be demanded throughout Canada. Briefly, one horse-power year will produce fertilizer for 100 acres of cultivated wheat land, so that 1,000,000 horse-power, on the 65 per cent. load factor available, would produce fertilizer for 100,000 square miles. There is no question of our complete dependence on manufactured nitrates in the not far distant future and on a scale which involves millions of horse-power.

Or it may be that the demand for electrical heating will be such that this load will be of primary importance itself, and the future form of heating equipment by which electrical heating will be accomplished may be, of necessity, radically different from the present-day devices to meet the requirements. Economical heating apparatus will undoubtedly be of the heat-storing type, so as to take advantage of the power available on the off-peak periods. These may use masses of high specific heat materials, or even steam reservoirs, in which to store and liberate heat over a 24-hour cycle; and, further, the 24-hour use of electricity may be arranged to meet only the average conditions, the surplus available during below-average periods being used for the manufacture of fuels, such as hydrogen, to be stored for use in the above average periods, thus providing a continuous electrical heating load over a yearly cycle.

The combination of the maximum developments of many of our great power sites should, when the non-heating load period has been organized to use power along other lines. or when a continuous heating load on a yearly cycle is established, readily make power available for electric heating purposes at an equivalent cost of less than $12 per horse-power year delivered in districts even remote from the generating source. Then the rate for heating purposes would be below .2 cents per kilowatt hour, or 1 cent would purchase over 18,000 British thermal units of applied heat. Electricity then, if available in the necessary quantities, would readily become the foremost source of artificial heat.

The use of electricity for many of the other domestic uses for heat, such as for cooking, water heating, etc., is well established, and forms no mean portion of the present electrical loads.

Power Development May Exceed Present Estimates

Now, when we speak of millions of horse-power and our possible future dependence on a general use of electrical heating in Central Canada are we justified in anticipating that such enormous quantities of power will be available

The latest comprehensive compilation of water-power resources in Canada gives a total of about 18,000,000 horse-power available in the 2.000,000 of the 3,729,700 square miles of Canada's area which may be expected to be fairly thickly populated within the next few decades. It is stipulated for this figure that it is "inclusive in the case of Niagara Falls. Fort Frances, and the St. Mary's River at Sault Ste. Marie. of only the development permitted by international treaties. and, further, does not contemplate the full possibilities of storage for the improvement of capacities." The effect of such a restriction in the compilation of the totals of the water-power resources may be indicated by the available power on the Canadian side at Niagara Falls when developed to a maximum, being over 2,000,000 horse-power, while less than 500,000 horse-power is permitted by agreements, the restrictions being practically dictated by the desire to retain the scenic beauty of the falls. Again, practically all the water-powers of Ontario on the Great Lakes and James Bay sides of the height of land are quite dependent on storage, so that, instead of some 5,500,000 horse-power being listed as Ontario's portion, 12,000,000 here alone would more likely represent the possible development that the future may see. and it may be that, instead of 17,820,000 horse power in the

southerly half of Canada, 35,000,000 horse-power may be produced.

The present enormous use of electric power really had its inception 25 years ago, when electric power was first transmitted from Niagara Falls, N.Y., to Buffalo, while in Canada, in the last 12 years, the demand has jumped from about zero to the astounding figures of the present. To-day, while there are 409,000 horse-power generated at Niagara Falls, there is a serious power shortage, and the power-users are feverishly awaiting further developments of hundreds of thousands of horse-power at this source. If since 1905, and more particularly just within the last few years, the power demand has grown so rapidly, what will fifty years from now see? Possibly it will then be a scarcity of sites to develop, and all may be interconnected into a vast network of transmission and distributing lines, all the sources combining to obtain the maximum of energy from the widely-distributed water-falls.

Eectric Heating Feasible at $12 Per H.P.

In conclusion, I would briefly summarize as follows:

1. Electric heating is not a present economic possibility, due to high cost and lack of available power.

2. Electric power rates would have to be one-quarter of the present rates for electric heating to compete with heating by anthracite coal.

3. Many millions of horse-power would be required to meet even present requirements. For example, I would estimate a demand of 2,000,000 horse-power to heat Toronto's dwellings and other buildings, or 4 horse-power per person of population.

4. When millions of horse-power in Canada are developed and, say, delivered $12 power is attained, a large electric heating load may be established. This, of course, does not mean that every portion of the country could be served, but areas representing the great bulk of the population would be in the zones of distribution from such powers, and it might thus be possible to greatly substitute for coal and other fuels.

5. It may be that the economic future of our fuel and water-power resources will demand that in their administration fuels will be reserved for heating purposes and that the hydro-electric power available will be substituted to the maximum for all mechanical, railroad, and metallurgical operations.

6. By the use of devices for heat storing and fuel manufacturing, in combined or separate installations, so as to use throughout the yearly cycle a continuous heating load of 100 per cent. load factor, but of average rather than of peak demand, electric heating might be given a positively economic status, or, further the development of loads in millions of horse-power equalling in demand the electric power required for heating, yet elastic enough in its use to adapt to the low load periods of heating, may again suffice to make electrical heating of economic importance.

Discussion on Electric Heating

By Mr. H. G. Acres*

The four papers we have just heard cover such a vast field and furnish such limitless opportunities for discussion and conjuncture that it is impossible to touch on more than one or two of the many points which are worth enlarging upon. In the first place I wish to consider, briefly, a matter alluded to by Mr. Challies and dealt with more at length by Mr. Mitchell; namely, house heating by electricity. Mr. Mitchell has very ably elucidated some points with reference to the feasibility of heating buildings, which perhaps are not generally appreciated, and it might be interesting to enlarge upon some of his conclusions with special reference to the problem of heating the city of Toronto with Niagara power.

First, as to cost—What fundamental condition accounts for the fact that a house in Toronto can be more cheaply heated by means of Pennsylvania coal than by Niagara power, supplied at actual cost? To work this out let us first take one kw. of potential heat from the falling waters of Niagara. Under peak load conditions, there will be 85 per cent. of this unit of heat left when it has passed through the turbine; 80 per cent. when it has passed through the generator; 76 per cent. when it has passed through the step-up transformer; possibly not more than 66 per cent. when it has passed over the transmission line; 62 per cent. when it has passed through the step-down transformer; 57 per cent. when it has passed through the local distribution system and 52 per cent. when it has passed through the service transformer. In other words, about one-half of this unit of heat would be left for effective use as heat on the premises of the consumer.

Then take a pound of coal from a Pennsylvania mine—the whole of this pound is delivered to the consumer's premises. It contains about 2 kw. hours of effective potential heat for which you pay ½ cent on the basis of present price of coal, or ¼ cent for 1 kw. hour, as against 9/10ths of a cent for the kw. hour of heat from Niagara, on the basis of present rates.

Six Steps in Converting Niagara Energy for Heat

This kilowatt of potential heat from Niagara undergoes six distinct steps of conversion before it is delivered on the consumer's premises as heat. The potential heat of the Pennsylvania coal undergoes one conversion only before being put to its ultimate use. The efficiency of conversion from the natural state to ultimate use is probably about the same, but in one case you require a power plant, a step-up transformer; 80 miles of transmission line; a step-down transformer; a distribution system and a service transformer. In the other you require a $200 furnace and a 50 cent shovel. These two conditions relative to the delivery of the commodity must be considered as having a more or less fixed influence on comparative costs, and the only factors which will tend to any appreciable extent to reconcile the present disparity will be an enormous increase in the price of coal, or a compensating reduction in the cost of electric power, assuming, of course, that both commodities will be available for the use under discussion, which is another question altogether.

Then as to service conditions—I think there are about 80,000 buildings in the city of Toronto. It is safe to say that during the extreme weather last winter coal was being burnt in these buildings, for a day or two at a time, at an average rate of four tons per month, or, say, for a two-day period, on several occasions, an average of 270 pounds of coal was burnt in each building in the city. I think that is well on the conservative side. On the basis of this assumption it would require over 1,500,000 horse-power of station capacity at Niagara to heat Toronto in zero weather. Furthermore, on the basis of Mr. Mitchell's estimates of load factor, for two months only 65 per cent. of this power would be used, for two months only 45 per cent., for two months only 20 per cent., and for four months none would be used at all. This is a service condition which is absolutely unheard of at the present time. Under such circumstances an extraordinary operating condition would obtain, in that the load-factor on the generating plant would be mainly controlled by the direction of the wind. On several occasions last winter the rise in temperature due to changing wind direction might have pulled half a million kw. off the station busses over night. Mr. Mitchell has suggested a solution of this load-factor problem as far as the generating plant is concerned, but even granting that industries could be es-

*Hydraulic Engineer, Ontario Hydro-Electric Commission.

tablished at Niagara which could economically absorb these enormous quantities of off-peak power, it would not help Toronto, with over 1,000,000 h.p. of installed transformer capacity operating at 35 per cent. load-factor, together with the necessary transmission line capacity to Niagara Falls.

Market Will Develop for Off-Peak Power

In submitting these very approximate figures, I have, of course, not considered the matter of off-peak power. If the price of coal holds at the present figure, or tends to increase, there is undoubtedly a commercial possibility of using electric power as an auxiliary heating medium during off-peak hours, and a rate for this class of service could possibly be fixed sufficiently low to attract some consumers. This phase of the question cannot, however, be discussed very intelligently except at considerable length and on an essentially technical basis.

I may say here that the hypothetical service condition I have just described is one which is certain to obtain in the future at Niagara and at other large hydro-electric power centres, though in a much less acute form. The time is not far distant when the scarcity of power in what Mr. Challies has called the "acute fuel area" will revolutionize the present conditions and rules of service, and a certain class of consumers will develop who will be glad enough to make use, not only of all available off-peak power, but also to take advantage of such power as may be intermittently available during higher stages of flow. Those having to do with the development of hydro-electric power should, therefore, bear in mind that it is only a question of time when the scarcity of fuel and the approaching ultimate exhaustion of hydraulic power resources will make the production of intermittent power not only profitable, but necessary for the public welfare, and permanent works at least should be designed against such a contingency.

Now referring again to Mr. Challies' paper, I think the most important and significant section of the same is that which considers the use of Canada's fuel-power resources according to their adaptability. In considering this phase of the problem we are rather on the horns of a dilemma. Should we consider the advisability or possibility of moving out of the "acute fuel area" such industries as are mainly dependent on coal as a raw material or as a source of power, and of replacing them by industries mainly dependent on water-generated power, or should we look after these industries as best we can by centralized heating plants and out of our future allotments of imported coal? In other words, should the problem of adaptability be attacked on the basis of adapting our fuel power resources to industry as now existing and located, or on the basis of adapting industry to our fuel power resources?

Large Industries May Absorb Excessive Amount of Power

I have in mind one instance which will serve as an illustration of the working of the latter alternative; that is, adapting an industry to our fuel-power resources. Cyanamid, calcium carbide and carborundum are made by processes requiring large quantities of cheap power. They also require large quantities of carbonaceous material which is now supplied in the form of coke made from Pennsylvania coal. There are two points to be considered in connection with this proposition, the most evident being, of course, the necessity of importing coal for such of these industries as are located in the "acute fuel areas." The other point is that the uncontrolled expansion of such industries as these in the vicinity of our large boundary water powers will in the near future absorb capacity that at a slightly more remote period may be urgently needed to keep alive a multiplicity of small industries scattered throughout the territory which is within transmission distance of these sources of power. For unlimited development of large local industries in the vicinity of our large boundary water powers is, therefore, a possible condition of the future which would seem to be undesirable. As against the possibility of such a situation developing in the "acute fuel area" we have, for instance, the Nelson River, a virgin field for hydraulic power exploitation furnishing unrivalled opportunity for the appropriate and efficient location of industry. Three million horsepower of commercially utilizable energy, all more or less accessible to the Hudson Bay Railway, and lying on the very threshold of the Empire's granary. Two million horsepower of this capacity would supply sufficient fertilizer for the whole of the northwest wheat area. Nitrogen and limestone are locally available, and the only important ingredient lacking is carbon. Whether this lack can be made good by western lignite I do not know. That is part of the problem. Crow's Nest coal and Welsh coal, via Port Nelson, would, of course, be available at a price. Here is a problem which is directly in line with the all-important issue under discussion at this meeting, and one which, if intensively studied, would at least serve the purpose of establishing certain fundamental laws which should govern the use of our fuel power resources in relation to their peculiar adaptability. A co-related phase of this study would be to ascertain to what degree the use of the water-powers in the "acute fuel area," more particularly the boundary water-powers, should be controlled so as to preserve an equitable balance between the amounts of power allotted to large local electro-chemical and electro-thermal industries and the amounts of power required, or likely to be required, for general distribution purposes. As a general rule the industrial centres immediately adjacent to the developed power sites will be the first to benefit, but the inevitable result of industrial expansion will be to include more and more of the surrounding territory within the zones of influence of these sources of power, and it is supremely important that these zones shall expand freely along economic lines and not be forced into unnatural channels by private interest or other influences which should have no prior status in the control of a national asset of such magnitude as our water powers.

True Glory of Niagara is its Potentiality

Now, before closing, I would like to mention another matter more or less directly related to the issue under discussion, and which has been briefly referred to by Mr. Mitchell. Probably 90 per cent. of the civilized inhabitants of this planet know Niagara only as a scenic spectacle. Most of them have nevertheless felt the commercial influence of Niagara without realizing it. Their first-hand knowledge of the world's most important water power has, however, been derived chiefly from picture post cards. Since power was first developed at Niagara Falls a continuous campaign of opposition to the commercial exploitation of Niagara has been carried on, based on aesthetic grounds. This opposition has left its mark on legislation on both sides of the line and on the Boundary Waters Treaty. As a matter of fact it is largely responsible for the present shortage of power.

The term "commercial exploitation" may sound cold blooded, but we may as well call a spade a spade, and anyway, in my opinion, the true glory of Niagara lies not in the roar and the rainbows, but in the vast potentiality of the falling waters, considered in the light of an instrument placed in our hands by a Divine Providence for a beneficent purpose, or, as Sir Adam Beck expressed it eight years ago, "to raise the scale of living of our citizens, and to multiply and cheapen the comforts of life." Niagara can have no greater destiny than this, and while aesthetic opposition to the commercial exploitation of Niagara must ultimately fade in the face of these more pressing issues, I think the process should be accelerated as much as possible.

The Dealer and Contractor

Further Light on the Goodwin Plan of Organization—No Price Fixing Planned—Quantity Will Always be a Factor—Educate the Curbstone Contractor

Speaking before the Illinois Contractors' Association recently on his merchandising plan, Mr. W. L. Goodwin said:

"Some people have been saying that I have an ulterior motive in assisting to organize a better contractor-dealers' association. I tell you frankly, gentlemen, that I have an ulterior motive. And I'll tell you what it is.

"I believe the electrical industry has a greater responsibility than any other single industry in the extent to which it can serve the public with both their necessities and conveniences. Hence the business is capable of great expansion. I believe it can be made the foremost of our industries, and that is the purpose of developing a thorough organization.

"I want to see it develop its ability to serve the public until its annual sales amount to $30 or more per capita of the population—instead of $7 per capita as it is to-day. That's my ulterior motive!"

Question-Box Was Feature

At this meeting the question box was a prominent feature. Everyone was invited to put any questions concerning the plan in the box, and was assured that the questions would be answered by Mr. Goodwin. It was not even necessary for the enquirer to sign his name to the questions. When the box was opened there were 62 questions in it. Here are some of the more important questions and the answers as given by Mr. Goodwin:

Q.—You said the average jobber's overhead was about 15 per cent. and that that figure was too high. What should it be?

A.—The jobber's overhead should not exceed the cost to the manufacturer of doing the same work. That might be more than 15 per cent. on some specialties, but it certainly would be less than 15 per cent. on certain staple products. The jobber at the present time lumps his overhead when he ought to figure the cost of warehousing and handling on different lines according to what the cost of warehousing and handling is.

Q.—Does your plan contemplate dealing with labor

A.—The plan does not contemplate dealing with labor in any phase.

Q.—Should not association secretaries furnish members with data on cost of operating electrical appliances?

A.—It would be a good idea for the national association to get out a sheet for the data book showing the average cost of operation of all of the principal electrical appliances.

Q.—Where do the fixture people come in under the Goodwin plan?

A.—The manufacturers belong in the fixture section of the Associated Manufacturers of Electrical Supplies. The retailers of fixtures whose problem is a retail problem should be a part of the National Association of Electrical Contractors and Dealers, where identical problems are discussed.

Q.—Does the plan contemplate abolishing schedules based on quantity purchases

A.—I believe that quantity will always control price. There is nothing in the plan that contemplates price fixing. It is believed that the plan will standardize rates of profit.

Q.—Will the Goodwin plan teach contractors the fundamentals of electricity

A.—The plan does not contemplate developing in the contractor a knowledge of electricity. He is supposed to have that knowledge. But it does propose to teach him merchandising methods.

Q.—What will happen to the manufacturers' agents if the Goodwin plan succeeds

A.—There is a place in the plan and in the industry for the manufacturer's agent. If he is a real manufacturer's agent he stands at the same place on the Wheatstone Bridge diagram as the manufacturer stands.

Q.—How can this merchandising movement help the man who cannot leave his store to attend the meetings,

A.—In California there were a few retailers who, when this movement was first started, could not leave their places of business to attend the meetings. To overcome this difficulty some of the jobbers sent their salesmen out to run the stores of these men while they attended the meeting, and it was not long before these merchants were doing enough business so that they could afford to leave their store to attend the association's activities.

Q.—What can be done with the curbstone contractor?

A.—The curbstone contractor must be educated. The best person to educate him is the jobber. The jobber should send his bookkeeper to the curbstoner and show him what overhead is. Such education will do much for him.

Q.—Under what classification would you place a railroad company?

A.—The railroad is a public utility company, and should be recognized as a trade buyer.

Q.—Is the Goodwin plan legal?

A.—The plan is not in restraint of trade according to the best legal advice I can get.

Q.—Does the plan encourage time and material work?

A.—The Goodwin plan encourages the contractor to take work on the time-and-material basis, because that is a basis which is economically sound and, in the long run, is cheaper for the consumer.

Q.—Is the central station eligible to membership in the contractors' association?

A.—If the central station conducts a retail business it is eligible to membership, and its dues would be based upon the amount of retail merchandising business which it does. Any retailer of electrical merchandise is eligible to membership.

The annual report of the Department of Telephones of the Province of Saskatchewan for the financial year ended April 30, 1917, is just received. The total number of stations in the province is now 43,993, made up of 18,669 government stations, 23,813 rural stations, and 1,511 other systems. The number of long distance pole miles is now 3,275, and long distance wire miles 18,833.

Increasing a Central Station Power Load

Where Energy is Available the Summer Offers Big Opportunities— The Contractor Should Co-operate and Profit

Though certain sections of the Dominion suffer from a shortage of electric power, the city of Winnipeg hydro-electric plant as it now stands can supply some 14,000 customers more than the 36,000 at present taking energy from its lines. For this reason the City Light and Power Department are justified in inaugurating a vigorous campaign for the greater use of the smaller electrical appliances and also of the electric range, which is already used in the city of Winnipeg probably to a greater extent than in any other city in Canada.

The sales manager of the Winnipeg City Light and Power Department, Mr. R. A. Sara, recently outlined a campaign beginning in February and which will continue through the summer season. In February they pubilshed a booklet entitled "Brighter and Happier Hours in Your Kitchen." This was an attractive booklet, explaining the advantages of using electricity for cooking and for the operation of all appliances



The department published an attractive booklet.

in the home, giving figures on cost, a number of useful recipes, the written opinions of a number of Winnipeg householders who had used electricity for cooking purposes, and finally a list of Winnipeg users of electric ranges, running into six pages of the booklet.

An advance copy of this booklet was sent to the Winnipeg Free Press, which published a good leader, entitled, "An Enterprising Civic Department," pointing out, among other things, that, while the cost of practically everything which enters into our daily life has increased, electricity alone is lower. The article also pointed out the universal use now being made of electricity in the homes, hospitals, cafeterias, lunch rooms, hotels, offices, and so on, and finally pointed out that the use of electricity developed from water-power conserves our fuel supply.

The following day the department mailed a copy of the booklet, accompanied by letter No. 1 to every individual whose name appeared in the booklet. A little later, March 22, they posted 10,000 of letter No. 2, with return postcard enclosed. This letter was addressed to the lady of the house. A copy of the booklet mentioned above, accompanied by an invitation to visit the showrooms of the department was sent to every person replying to letter No. 2.

For those failing to reply to letter No. 2, letter No. 3 was prepared and addressed to the man of the house, also with a return postcard.

On March 26 an advertisement appeared in the three city dailies offering prizes to school children for the best essay on "Electric Cooking." This advertisement is shown herewith. In May it is planned to issue a letter pointing out the advantages of electric cooking in hot weather. Each month further advertising matter in the form of 36,000 carefully-worded leaflets (different each month) are being enclosed with the


Contest for School Boys and Girls

$100 IN PRIZES $100

Any Winnipeg School Pupil Eligible

The government and the press are urging the public to conserve fuel and food, and in order to familiarize the citizens of Winnipeg with the savings that can be effected in both fuel and food, by the use of ELECTRIC fuel for cooking, we offer the following prizes to local boys and girls for the best essay on "The Advantages of Cooking with an Electric Range"

First Grand Prize $25.00 Second Grand Prize $15.00

Four Classes—Three Prizes in Each—To give the younger children the same opportunity as those in the advanced grades the following prizes will be awarded, according to age, class one, ages 10 to 12; class two, ages 12 to 14, class three, ages 14 to 16, class four, ages 16 to 18. First, second and third prize in each class will be awarded after the Grand Prizes

First Prize, $8.00 Second Prize, $5.00 Third Prize, $2.00

All essays must be in City Power Office by 12 noon, April 4th Winners will be announced Monday, April 10th

RULES OF CONTEST

The Fuel Situation

We Make It Easy for You to Get Information

Free Book on "Electric Cooking"

ENTRY COUPON

City Light & Power Dept.

54 KING STREET Phone Garry 1800

Offered prizes for best essay.

monthly lighting accounts. All envelopes have an advertisement printed on them, matter being changed each month (this also applies to the envelopes used by the municipal water department for sending out water bills).

For several weeks this department have also been holding business talks from 8.30 a.m. to 9.15 a.m., when a number of subjects have been discussed, as shown by the accompany-

ing program. These have proved most beneficial, as not only have they been instructive, but they have created a more general interest among the staff. The department at the present time is inaugurating "team work" among the employees. All willing to canvass and sell ranges in their spare time are requested to enter their names; teams comprising equal numbers have been selected by a committee and a captain chosen by each team. Prizes are offered for the best results of teams each month; also for best individual work. This scheme

Please forward your Booklet entitled
"BRIGHTER and HAPPIER HOURS IN YOUR KITCHEN"

It is understood that this puts me under no obligation whatever.

Name .....

Address .....

Number in Family .....

I now cook with | GAS / OIL / WOOD or COAL

Copy of return post card.

started on April 1, and results are not yet available, but at last reports meetings were being held by the different teams for the organization of this campaign. Both men and women solicitors are out on a commission basis, and a system of follow-up has been inaugurated, which is kept track of by a card-filing system.

The department report that they have already sold more than five times the number of ranges during the first three months of this year as were sold in the same period last year.

PROGRAM OF CONFERENCES
CITY LIGHT AND POWER DEPARTMENT
DAILY, from 8.30 to 9.15 a.m. SHARP
Commencing Tuesday, Feb. 19th, 1918.

1st Day—R. A. Sara, sales manager City Light and Power Department: "Object of Conferences—Program—Suggestions on What Is Required."

2nd Day—J. G. Glassco, general manager City Light and Power Department. "City Light and Power Department, Historical and Financial Review."

3rd Day—H. W. Billing, manager Northern Electric Company: "Salesmanship."

4th Day—(Friday, 22nd) G. W. Markle, managing director Henry Birks & Sons: "Efficiency in Selling."

5th Day—A. J. Crosbie, meter superintendent, City Light and Power Department: "Electric Meters."

6th Day—W. P. Tice, Northern Electric Company: "Hughes Electric Ranges."

7th Day—W. E. Wright, manager National Cash Register Company: "How to Close a Sale."

8th Day—F. J. Malby, assistant accountant, City Light and Power Department: "Analysis of Sales of Current as Shown by Hollerith Statistical Department."

9th Day—Demonstration of sale of electric range.

10th Day—S. Thorn, Great West Electric Company: "Moffat Electric Ranges."

11th Day—R. V. Slavin, power engineer, City Light and Power Department: "City Light, Power and Heating Rates."

12th Day—E. V. Caton, chief engineer, City Light and Power Department: "Electric Heating of Water."

13th Day—J. Swan, appliance salesman, City Light and Power Department: "Gas Stoves—Why NOT to Use Them."

14th Day—A. J. Appleton, operating superintendent, City Light and Power Department: "Characteristics of Different Loads."

15th Day—Theo. A. Hunt, K.C., City Solicitor: "Service to the Public."

16th Day—Advertising: "Discussion as to Form and Mediums."

Further subjects will be added from time to time as occasion arises. Conferences will be continued two mornings a week, after the course is completed, to discuss points which arise and to supply information to salesmen and formulate policies.

Program subject to change as occasion may arise.

Letter No. 1

Dear Sir:

"BRIGHTER AND HAPPIER HOURS IN YOUR KITCHEN" is the title of a booklet just published which will be of particular interest to you. A copy is enclosed. In connection therewith we have taken the liberty of referring, on Page ..., to the installation of an Electric Range in your residence.

We have endeavored to embody in this publication the most up-to-date and complete information obtainable on Electric Cooking, Electric Washing, and other applications of Electricity in the home, with particular regard to their use IN WINNIPEG. You will observe that, with the exception of one or two letters from world-famous cooking experts on page 10, all of the references, recommendations, and other data refer to our own city, WINNIPEG. The lists of users contained on pages 23 to 28, inclusive, will give an idea of the large number of our citizens who are already cooking exclusively with electricity.

We trust that the recipes on pages 12 and 16 will be of service to you.

Are there any points about Electric Cooking or the application of electricity to any problem in your home on which you would like further information? Is your Electric Range satisfactory? Is it economical, and can you suggest any improvement? This subject is vital, particularly in these days of the high price of fuel and coal shortage.

Yours truly,
CITY LIGHT AND POWER DEPARTMENT.
R. A. Sara,
Sales Manager.



an **ELECTRIC RANGE**
Will Cut Your Fuel Bill, for Cooking, in HALF—

"COOK BY WIRE"

"ELECTRICITY"—*The Cheapest Fuel for Cooking*

All envelopes have advts. printed on them.

Letter No. 2

Dear Madam:

Last year 647 homes in Winnipeg, which formerly used high-priced gas, wood or coal, found it profitable to cook with low-priced electricity. The average saving effected by each in 1917 was $43.00. Not only did they save money, but they found it more convenient, cleaner, safer and that their cooking required less attention. These electric range users enjoy the lowest rate on this continent for fuel. They have proved

that the electric range saves food, that they have more time for pleasure, or other work; and the time they spend in the kitchen is enjoyable because it is a pleasure to cook with electricity. Probably one of your neighbors or friends is included in the above number and you would like to obtain direct information from them regarding their experience with electric cooking.

If you will sign and mail the enclosed Post Card we shall be pleased to send you a copy of our new booklet, "BRIGHTER AND HAPPIER HOURS IN YOUR KITCHEN."

It enumerates the advantages of electric cooking, its cleanliness, economy, safety and helpfulness. It contains photographs and descriptive matter of the newest and most up-to-date electric ranges, recipes, gives illustrations of a street in which EVERY HOME cooks exclusively with electricity, dozens of recommendations from people in Winnipeg cooking with electric ranges, and five pages of names and addresses of Winnipeg homes which "Cook by Wire." It shows how an average saving of $43.00 per year is made.

You will place yourself under no obligation whatever in asking for this booklet. The only criticism we have received to date is that it is rather expensive. We are at your service, and would like you to have a copy of "BRIGHTER AND HAPPIER HOURS IN YOUR KITCHEN."

Will you forward the enclosed card **now?**

Yours truly,

CITY LIGHT AND POWER DEPARTMENT,

R. A. Sara,

Sales Manager.

The City of Winnipeg Hydro Electric Plant, as it now stands, CAN supply 50,000 consumers, and practically the same overhead and financial charges will apply and the same staff will serve that number of consumers as now serve the 36,000 consumers already using City Light and Power.

IF 50,000 consumers are obtained, the COST of service per consumer will be greatly decreased, with a corresponding effect on rates charged.

ARE **YOU** USING CITY LIGHT and POWER?

These are attached to all letters.

Letter No. 3

Dear Sir:

In your office or factory you install new labor-saving machines to expedite your work and save time and money. If efficiency calls for these devices in the factory or office why not in the home? Help in the home is hard to get and more expensive than ever before.

Are you satisfied to let **your** wife worry along with an out-of-date cook stove when an electric range will save her hours of labor and transform the kitchen drudgery into "Brighter and Happier Hours"? Incidentally **you** will save half of the price you now pay for fuel for cooking, whether you use coal, wood, or gas.

You have probably entered your home many evenings and found the air heavy with the odor of half-burnt gas and your wife played out, after hours of work in the vitiated atmosphere. What a difference in the electric kitchen!—pure air, better cooked foods, your wife and children happier and healthier because electricity gives heat and nothing but pure heat.

Do you know there are streets in Winnipeg in which **every** home cooks exclusively with electricity? One of these streets is shown in our new booklet.

"BRIGHTER AND HAPPIER HOURS IN YOUR KITCHEN" not only states the advantages of electric cooking, its cleanliness, economy, safety and healthfulness, but also contains photographs and descriptive matter regarding the newest and most up-to-date ranges, recipes, dozens of recommendations from your friends and neighbors in Winnipeg who are cooking with electricity. Ask them how they like it. They will confirm our statements.

We would like to forward "BRIGHTER AND HAPPIER HOURS IN YOUR KITCHEN" if you will sign the enclosed Post Card and return it. This will place you under no obligation. Will you do it NOW?

At your service.

CITY LIGHT AND POWER DEPARTMENT,

R. A. Sara,

Sales Manager.

Low Price Warming Pad

To fill the demand for an electric warming pad at a less price than its standard 12 x 15 in. pad the Westinghouse Electric and Manufacturing Company has placed upon the market one of these pads, with dimensions 9 x 12 in. This pad is equipped with 15 feet of cord, with attachment plug. No switch is provided, the current being turned on and off at the lamp socket or by separating the attachment plug. To prevent overheating, two thermostats are enclosed in the pad. These are connected in series, and should the temperature rise to a point near the maximum safe value, one or the other will open the circuit. Upon a fall in temperature, the thermostat will reclose the circuit, thus maintaining the heat at a uniform temperature. This pad, which is enclosed in a fawn-colored felt cover, is very soft and pliable, thus allowing it to conform easily to any part of the body. Its marked superiority to the old-fashioned hot water bottle is well known, some of the advantages being its instant availability, its continued heat at uniform temperature, the absence of any danger of overheating or scalding the patient, or of wetting its surroundings, and the low cost of operation.

A Vest Pocket Power Plant

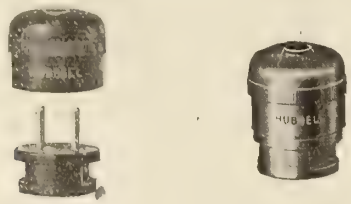
The Liberty Bell transformer is something new in the construction of bell transformers, in that it is of the socket type, and may be connected to the line by simply screwing it into any Edison base socket or receptacle. This permits even the inexperienced to connect it, and increases sales by cutting down the installation charges, which are generally so high as to impede competition of the bell transformer with batteries. Also the method of installation permits easy removal from one house to another, should the family move. All bothersome soldering is done away with in the installing



of this transformer. From the dealers' and jobbers' standpoint the extreme light weight and high capacity are important points. The complete weight is only ½ pound, and the 10-volt type will ring four 2½-inch bells, while the 16-volt type will ring seven 2½-inch bells. The transformer is enclosed in a neat black enameled case, with secondary terminals brought through a porcelain block, conveniently placed. The transformer is well made and impregnated, and does not depend upon any case-filling compound to exclude moisture. The device will not burn out on short circuit of the secondary terminals and claims an input of only 10 watts on short circuit. This transformer is also handy for the electrician in testing, being much lighter and less cumbersome than several dry cells to carry to the job.

Composition Motor Plug

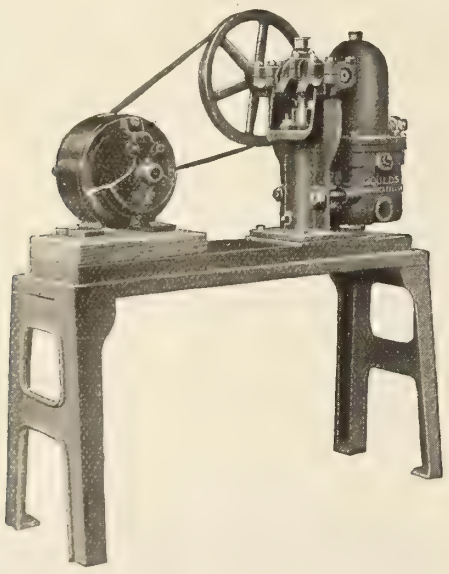
Harvey Hubbell, Inc., have placed on the market a composition motor attachment plug, No. 6179. This plug is designed for use with devices employing small motors, such as vacuum cleaners, floor-scrubbers, and the like. It is constructed of a high-grade, heat-proof composition, measuring,



assembled, 1 5/8 in. in length and 1 1/32 in. diameter at bottom of base. The portion with contact blades is arranged with holding slots or grooves for fitting into the apparatus, and all current-carrying parts of the portable body are carefully concealed within patented arcing chambers to prevent accidental contact.

New Electric-Driven Pump for Small Capacity Services

The Goulds Manufacturing Company, Seneca Falls, N.Y., have recently developed a new pump for service in homes, summer cottages, camps, dairies, small hotels, etc. This pump is known as the "Hi-Speed," and its predominating feature is its high speed of 500 r.p.m., which allows the pump to be belt-connected to the motor with only a small reduction and consequently with a small pump pulley instead of the larger



diameter pulley commonly used. The pump is of the vertical reciprocating type, and is suitable for pressures up to 43 pounds or 100 feet elevation. It is made in two sizes—1 1/4 in. diameter with 1 1/8 in. stroke and 2 in. diameter with 1 1/8 in. stroke. The former has a capacity of three gallons and the latter a capacity of six gallons per minute. The outfits are furnished with 1/4 horse-power, 1,750 r.p.m. Robbins & Myers motors.

Favorable Annual Report

The annual report of the Canadian Westinghouse Company for the year ending December 31, 1917, shows gross earnings from manufacturing operations of $1,567,199; net earnings are $846,276, and, after dividends are paid, there is a net balance of $347,024, which amount, added to the balance from the previous year, leaves a balance as at January 1, 1918, $1,301,616. The total assets of the company are now placed $3,955,110

Quiet Berwick Goes "On the Map"

A Halifax reader sends us the following from the "Herald" of that city. The cost of current for water-heating, under the circumstances, would not be prohibitive:

Berwick, April 2.—This town from now on will be "on the map." The progressive element have won out, and by a three to one vote have decided to install an electric light and power plant. Water and sewerage are next in order. Confidence is shown in the commission which is to handle the new development. The commissioners are F. B. Chute, M. L. Nichols, and E. W. Margeson, and it is understood they are to make a mill site about five miles distant and put in a new dam to provide the necessary water-power. There has long been objection to modern innovations in Berwick, and at the meeting referred to above one of the "diehards" used the following argument: "Why, we don't want the new-fangled things—lights, water, and sewerage. Every spring I have the missus heat some water and I take the washtub out on the kitchen floor and after everybody has gone to bed I splash around and have a good wash, and there have been some springs when I didn't have to."

Personal

Mr. Frank T. Groome, sales manager Benjamin Electric Company of Canada, who recently underwent an operation for appendicitis at the Western Hospital, Toronto, is reported making satisfactory progress. Mr. Groome has been removed to his home, and expects to be back in his office in two or three weeks.

Trade Publications

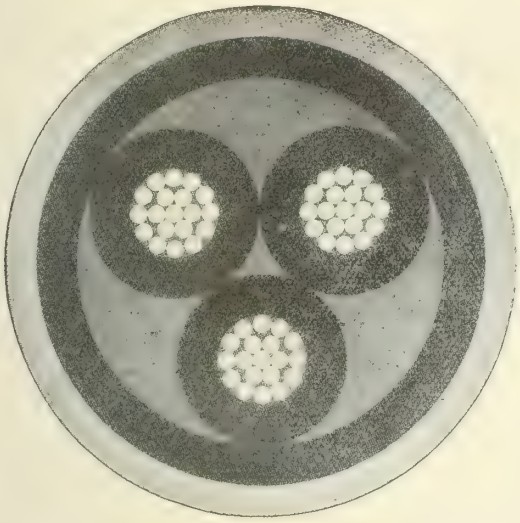
Boiler Economy—Booklet entitled "A Guide to Boiler Economy," issued by the Canadian General Electric Company, containing useful information on the operation of steam power plants.

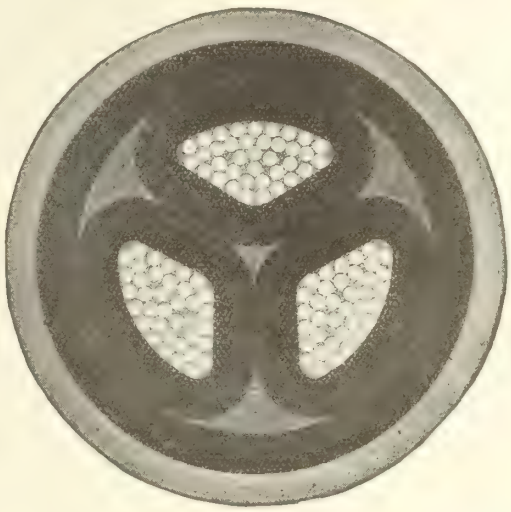
Condulets—Condulet Suggestion No. 16, by Crouse-Hinds Company of Canada, describing and illustrating battery charging condulets installed in a car on one of the largest continental railroads. The distinguishing features of these fittings are that the receptacle contacts are so supported as to prevent their being spread, that the contact area is unusually large, that firm contact is obtained on both inner and outer contact members at all times, and that the installation of the receptacle is greatly facilitated by a split form of bracket.

Lightning Arresters—A revision of Catalogue 1-A on lightning arresters has just been issued by the Westinghouse Electric and Manufacturing Company. After a brief treatment of lightning in general and ground connections, direct current lightning arresters are taken up. These are the familiar M.P. (multi-path) arresters, and the newer K-3 condenser type arrester. Both of these are designed especially for street railway use. The K-3 arrester contains a spark gap in series with a condenser, of the flat plate unit form having a capacity of one microfarad. To protect old equipment, in which the insulation has become weakened with age, the gap should be short circuited, as this prevents the voltage from rising to a point which might endanger the apparatus. With newer equipment, the spark gap should be left open, as this ensures that the condenser is always discharged, and therefore ready to take care of a larger static surge. The electrolytic lightning arrester for car service is also described. The line of type AK electrolytic arresters now includes a type provided with sphere gap having horn extensions on the higher voltages instead of horn gap only. There are a number of additions to the list of accessories and parts for these arresters. Outline drawings with approximate dimensions of type AK arresters in various settings complete the book, which is of much interest to electrical men having to do with transmission lines for power and railway purposes. Copies may be had on request at any Westinghouse branch office.

PHILLIPS' CABLES

as supplied to the Toronto Hydro Electric System





These illustrations show cross sections in the original size of cables recently supplied to the T. H. E. System and reordered by them for further extensions. The specifications are as follows.—Conductors composed of 37 strands each, .082 in. diameter. Thickness of dielectric on each conductor, .210 in. Thickness in belt, .210 in. Thickness of lead sheath, .160 in. Overall diameter, 2.61 in., 250,000 C.M. Three Conductor, Paper Insulated, and plain Lead Covered Cable for 13,200 volts. We can supply you with wires and cables of any size for Power, Lighting, Telephone, Telegraph, etc.

Write us for detailed information.

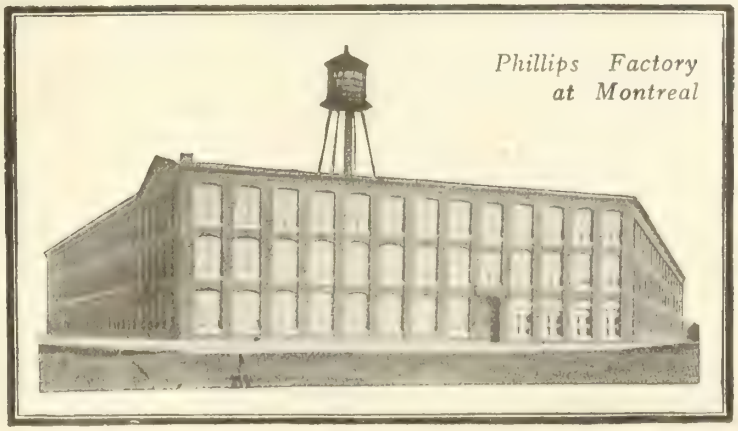
NOTE.—Specification of cable in left-hand cut: 3/0 B. and S. Three conductor. Each conductor 19 strands, each .094 in. diam. Thickness of dielectric on each conductor, .21 in. Thickness of dielectric on belt, .21 in. Thickness of lead sheath, .15 in. Overall diameter, 2.60.

Specification of cable in right-hand cut: As stated in copy.

Eugene F. Phillips Electrical Works, Ltd.

Head Office and Factory: MONTREAL

Branches: Toronto Winnipeg Regina Calgary Vancouver



Phillips Factory at Montreal

Current News and Notes

Amherstburg, Ont.

The purchase of the Essex County Light and Power Company by the Hydro-Electric Power Commission has been completed. The properties were owned and controlled by the Detroit-Edison Electric Company. The price paid was $226,000, covered by bonds of the Ontario Commission. The plant comprises some 50 miles of 26,400 volt lines, distributing energy to Amherstburg, Kingsville, Essex, Leamington, Harrow, Canard River, and Cottam.

Hamilton, Ont.

The Minister of Labor has established a board of conciliation to deal with the dispute between the Hamilton Street Railway Company and its employees.

Kingston, Ont.

The city auditor's report shows that the past year's operation of the civic utilities commission were carried on at a loss, in the electric department, of $6,792.

London, Ont.

Negotiations have been re-opened, it is said, looking to the purchase of the London and Lake Erie Railway and Transportation Company by the city of London.

The plant of the London Electric Company was closed down on April 1, and some 15,000 customers were left without light and power. It is understood that a deputation is being arranged to go to Ottawa and urge upon the power controller the necessity of continuiing the operation of this plant.

The London and Port Stanley Railway Commission is authorized to increase the standard passenger tariff by 15 per cent. and the freight rate on coal by 15c a ton.

Following the collapse of the Springbank dam recently, it is announced that the work will be replaced on a larger scale, making possible the generation of a greater amount of electric power. As the result of the break, one section of London's streets is in darkness.

The employees of the London Street Railway Company have made a demand for an increase of 10c an hour in wages, bringing the maximum up to 38c. The company point out that their system showed a deficit of $24,000 last year.

Montreal, Que.

The Shawinigan Water and Power Company have under consideration the extension of their carbide and electrode plants. Operations have been commenced on the large acetic acid plant which the company are building at Shawinigan Falls for the United States Government, and part of the electrical equipment has been purchased.

Ottawa, Ont.

The fuel controller has issued an order which would seem to indicate that all small power plants operated by steam where hydro-electric power is available will be closed down to assist in relieving the fuel shortage. It would seem that the aims of the fuel controller and of the power controller will more or less interfere in this respect, as the power controller's orders are chiefly to the effect that hydro-electric power must be conserved wherever possible by the use of other sources of heat.

Regina, Sask.

The street railway union is asking the following schedule of wages: 32c for the first six months, 35c for the second six months, 38c for the second year, 42c for the third and following years; also a 10 per cent. increase for all other employees, aside from motormen and conductors, getting less than $1,500 a year. The city's offer of an increase ranging from 2 to 10 per cent. has been rejected.

Rosthern, Sask.

On Monday, March 25, the new electric lighting plant was started up here. This is a gas engine-driven generator system.

St. John, N.B.

The New Brunswick Power Company are making a request to the legislature for power to make an increase in their rates. The company ask that the fare in future be a 6-cent cash fare, with a 1-cent charge for transfers.

It is announced that the Commission of Conservation will make a survey of the water-powers of New Brunswick during the coming summer.

Temiskaming, P.Q.

The Kipawa Fibre Company, Ltd., propose to develop a water-power at Kipawa Lake, Temiskaming, P.Q. The energy will be utilized for the manufacture of bleached sulphite pulp. At present the water is sufficient to develop 20,000 h.p., which can be increased to 35,000 h.p. if conservation work at the head waters is undertaken. It is estimated that the proposed power development of 7,200 h.p. will involve an outlay of $650,000, with an addition of $350,000 for water-power rights.

Toronto, Ont.

The damage which occurred from fire in the factory of the Jefferson Glass Company, Carlaw Avenue, will be immediately repaired, and the plant will be running smoothly again within the month. The building was of fireproof construction, with a wooden roof, and it is principally this roof that was damaged. In the meantime the company have a heavy stock of staple glassware, from which immediate shipment will be made to fill orders. It is not anticipated that the fire will interfere in any way with the company's service to their customers.

The Canadian General Electric Company, Ltd., have secured the agency for Canada of the Western Coil and Electrical Company, Racine, Wisconsin, manufacturers of high-grade violet-ray generators, high frequency outfits, etc.

Winnipeg, Man.

The City Council have instructed the city solicitor to prepare a by-law prohibiting the operation of jitneys in the city of Winnipeg.

Motor Operated Eraser

For use by draftsmen, the Coates Clipper Manufacturing Company is now making a motor operated eraser. The outfit consists of a 1/15 h.p. standard motor with a bail handle and 10 feet of cable for connecting to an electric light socket. It is fitted with 3 feet of ¼-in. cable shafting, with sliding sleeve connection, allowing for proper curvature of the shaft. This is covered with black braiding, and has nickel-plated sleeves throughout. At the end of the flexible shaft is a high-grade dental hand-piece and two mandrels, on which can be mounted discs of various kinds for erasing printing, waterproofing, pencil marks, and for cleaning purposes. Besides being used as an eraser, the maker points out that the rotating disc can be used by draftsmen and others for cleaning instruments, sharpening pencils, and the like.

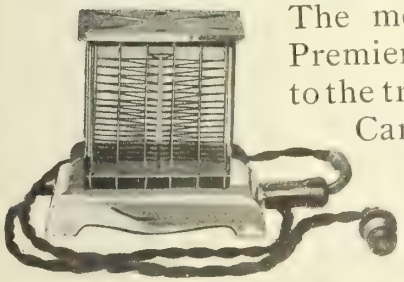
Premier

"The Strong Line of Appliances"

Three things are winning electrical dealers to Premier appliances:



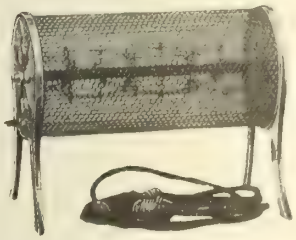
Quick Sales
Good Profits
High Quality



The men behind the Premier line are known to the trade throughout Canada. They have always stood back of quality products.

You can unhesitatingly guarantee any Premier—We do. Premier quality makes friends for your store. Premiers in your window advertise your store as a quality store.





Four big sellers are illustrated here

Get prices on them.

Ask us for our complete price list.

SUPERIOR ELECTRICS

LIMITED

Pembroke, - Ontario

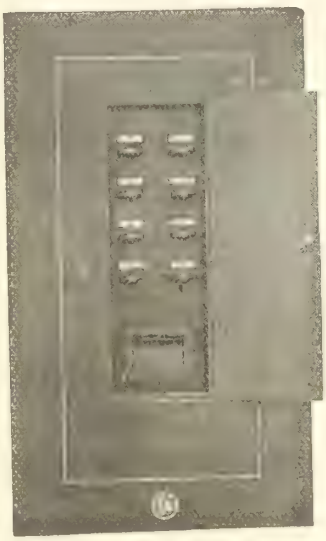


Our Service

Not only promptness, attention and courtesy,—which we render as a matter of course,—but a thorough knowledge of your needs in **ELECTRIC FIXTURES** and how to meet them.

Tallman Brass & Metal Co.
HAMILTON, ONT.

Representative—
Toronto—J. A. McKay, 108 Grace Street.
Agents—
Montreal—Armour Bros.—122 Board of Trade Building.
Winnipeg—Reynolds & Co.—406 Confederation Life Building.



Safety Panels and Switchboards

For Office, Theatre and Factory Buildings

Write us for information and prices

Transformers, Meters, Enclosed and Plug Fuses, Pole Line Material, Safety Service Boxes, Lamps of all kinds

Everything Electrical — Try us for Service

Rose & O'Hearn

220 King Street West - - TORONTO

We Are Open to Buy

[illegible] second hand equipment:

[illegible] 1400 and 6600 volt, 60 cycle, any [illegible]

100 meters, 60 cycle, 110 volts, 10 amp., of Westinghouse or C. G. E. make.

10 and 15 kw., 110 volt, direct current dynamos.

Several wall and ceiling mounting, single pole, disconnecting, high voltage switches.

6600 volt, 3-pole circuit breakers.

Ampere meters with current transformers.

[illegible] recording and graphic meters.

Box 714, Electrical News, Toronto. 8-8

PARLIAMENT BUILDINGS, OTTAWA

Tenders Wanted for Electric Conduit and Fittings

Sealed tenders will be received by the undersigned until noon, **April 23, 1918**, for Electric Conduit and Fittings required in the reconstruction of the above building.

All tenders to be based on the supplying and delivering on the site of the quantities of the schedule of material for electric conduit and fittings, in strict conformity with the specifications and the samples submitted, and to the satisfaction of the Architect.

Deliveries to commence so far as possible immediately after the signing of the contract and to continue as directed in such quantities as to ensure complete delivery by June 1, 1918.

The schedule of material, specification and any other information required can be obtained at the office of the P. Lyall & Sons Construction Company, Limited, Ottawa.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Minister of Public Works, for a sum not less than five per cent. (5 p.c.) of the amount of the tender, which will be forfeited if the parties tendering decline to enter into a contract when called upon to do so. If the tender is not accepted the cheque will be returned. If the tender is accepted an additional cheque for a sum equivalent to five per cent. (5 p.c.) of the amount of the tender must be deposited before the contract is signed. The total security will be forfeited if the contractor fails to complete the work contracted for.

Payments for material will be made monthly.

Samples must be submitted with tender.

The lowest or any tender not necessarily accepted.

Envelopes containing tenders to be marked, "Tenders for Electric Conduit and Fittings" and addressed to the undersigned.

JOHN A. PEARSON, Architect.
J. O. MARCHAND, Associate.
Centre Block, Parliament Hill,
Ottawa. 8-8

Generator Set Wanted

Wanted—35 to 50 K.W. 125/250 volt 3 wire D.C. Generator, direct connected to High Speed Engine. Write The Kaufman Rubber Co., Ltd., Kitchener, Ontario. 5-8

Cable For Sale

8742 lbs. 1,000,000 C.M. Triple Braid Wacco Cable, 2500 feet.
3531 lbs. 500,000 C.M. Triple Braid Wacco Cable, 1755 feet.
Subject to immediate delivery and prior sale.
Box No. 707, Electrical News, Toronto. F

POSITIONS VACANT

COMMERCIAL ENGINEER WANTED, with experience on Switchboard and Power House design. Must be conversant with modern switchboard apparatus and its applications. Apply to Box 719, Electrical News, Toronto, giving complete information. 8-8

EXPERIENCED ELECTRICAL SALES ENGINEER REQUIRED for responsible position in Montreal sales office. Applicant must be exempt from military service. Details of technical and sales experience and salary expected should be given. Address Box 717, Electrical News, Toronto. 8-8

PETRIE'S LIST

of New and Used

MOTORS

for Immediate Delivery

No.	H.P.	Phase	Cycle	Volts	Speed	Maker
1	75	3	25	550	720	Westg.
1	50	3	25	550	850	Westg.
1	50	3	25	550	720	Westg.
1	40	3	25	550	750	C. G. E.
2	40	3	25	550	710	Westg.
2	35	3	25	550	720	Westg.
1	30	3	25	550	710	Swedish
1	25	3	25	2000	900	C. G. E.
2	20	3	25	550	710	Westg.
1	20	3	25	550	500	C. G. E.
4	15	3	25	550	750	C. G. E.
1	10	3	25	550	750	C. G. E.
4	10	3	25	550	720	Westg.
1	7½	3	25	550	720	Westg.
3	7½	3	25	550	750	C. G. E.
1	5	3	25	550	1440	Excelsior
2	2	3	25	550	1400	Excelsior

Write Us for Prices

H. W. PETRIE, Limited

Front St. West - Toronto, Ont.

NOTICE

New Equipment at Low Prices

GENERATORS

1—300 K.V.A., 60 cycle, 2,200 volt, 3 phase.

1—275 K.V.A., 25 cycle, 6,600 volt, 3 phase.

1—100 K.V.A., 60 cycle, 550 volt, 3 phase.

1—17 K.W., 250 volt D.C.

1—40 K.W., 250 volt D.C. Direct connected to engine.

3—100 K.V.A., 25 cycle. Transformers S.P. 13,200 to 6,600/2,200.

Motors All Types

Immediate Delivery

E. A. LOWRY

209 King St. - GUELPH, ONT.

PROCURED IN ALL COUNTRIES
LONG EXPERIENCE IN PATENT LITIGATION

SEND FOR HAND BOOK

PATENTS

PHONE MAIN 2582

RIDOUT & MAYBEE

59 Yonge Street

TORONTO - - - CANADA

Rubber Covered Wires and Cables

FOR POWER, LIGHT AND TELEPHONE WORK

Incandescent Lamp Cord, Flexible Switchboard Cables, Special Cords and Cables for all kinds of Electrical Work.

Prompt Shipments from Canadian Factory.

BOSTON INSULATED WIRE & CABLE CO., Limited

Canadian Office and Factory, HAMILTON, ONT.

3 Phase, 25 Cycle, 220 volt Motors

Immediate Delivery

No.	H.P.	Make	Speed	Type	Form
1	100	General Electric	500		
1	50	Allis-Chalmers	750		
2	50	General Electric	720		
1	50	General Electric	500	I	K
1	35	General Electric	750	I	K
1	35	General Electric	1500		
3	25	General Electric	750	I	K
1	20	General Electric	750	I	K
1	15	General Electric	750	I	K
6	10	General Electric	750	I	K
7	5	General Electric	1500	KT	C

3 Phase, 25 Cycle, 220 volt Motors

Ready for Delivery in March

No.	H.P.	Make	Speed	Type	Form
1	200	General Electric	500	I	K
1	150	Westinghouse	485		C
1	100	General Electric	750	I	K
2	60	General Electric	750	I	K
11	3	General Electric	1500	KT	
6	2	General Electric	1500	KT	

JOSEPH MYERSON

274 Commercial St. - BOSTON, MASS.

Selections from Our Stock of Motors

3 Phase, 60 and 25 Cycles

3 PHASE, 60 CYCLE MOTORS

Qu.	H.P.	Make	Volts	Type	Speed
1	¼	R&M NEW.	110		1700
1	½	G.E.NEW. .	110	KT	1800
1	½	G.E.	110	I	1800
5	1	G.E.NEW. .	220	KT	1800
1	1	G.E.	220	KT	1800
1	1	Fbks. M. ..	440	B	1200
2	2	G.E.	220	KT	900
5	2	G.E.NEW. .	220	KT	1800
5	3	Wstgh. New	220	CS	1130
2	3	R&M NEW.	220		1150
4	3	G.E.	220	KT	1800
6	3	G.E.NEW. .	220	KT	1800
1	3	G.E.	220	KT	900
3	3	G.E.	220	KT	1200
1	3	Cr.Wh. . ..	220		1720
6	5	G.E.NEW. .	220	KT	1800
1	5	G.E.	220	KT	1800
1	5	G.E.	220	KT	1200
3	5	Cr.Wh. .. .	220	Q	1720
1	5	Cr.Wh. .. .	550	Q	1720
1	5	Wstgh.	220	CCL	1700
10	5	Wstgh. New	220	CS	1735
3	5	Wstgh. New	220	CS	1130
29	7	G.E. (motors only)	550		1200
1	7½-15	Cr.Wh..	220/440		865/1735
3	7½	G.E.NEW. .	220	KT	1800
2	7½	G.E.NEW. .	220	KT	1200
6	7½	G.E. (motors only)	550	KT	1800
2	7½	G.E.NEW. .	220	KT	900
2	10	G.E.NEW .	220	KT	1800
4	10	G.E.NEW. .	220	KT	1200
1	10	Wstgh.	220	CCL	1700
1	10	Wstgh. . ..	220	CS	1150
1	10	Cr.Wh. with resistance type starter	550	Q	1800
3	15	G.E.NEW. .	220	KT	1200
2	15	G.E.NEW. .	220	KT	900
3	15	R&MNEW.	220		1150
3	15	Fbks.M.	220/440	KBV	1200
2	20	Wstgh. . .	220	CS	1160
1	20	Fbks.M. . .	220	B	1200
50	20	Fbks.M.	220/440	KBV	1200
19	25	Wagner	220/440	BP	1120
2	30	Wagner NEW	220		850
1	35	G.E.	220	KT	600
1	35	G.E.	220	KT	720
1	35	Triumph	220/440		900
1	40	Wagner NEW.	220/440	BP	850
1	40	Fbks.M. . .	220		900
2	40	G.E.NEW. .	220	KT	1200
1	50	Triumph . .	220		720
1	50	G.E.NEW. .	220	KT	900
2	50	G.E.NEW .	440	KT	900
1	75	G.E.NEW. .	220	K	900
1	125	G.E.	2200	L	600
1	150	Wstgh. New	440	CW	695
1	150	G.E.NEW. .	220	M	580
1	200	G.E.NEW. .	440	M	600

3 PHASE, 25 CYCLE MOTORS

1	5	G.E. . . .	220	KT	750
1	12½	G.E.elev.type-high torque	220	KTE	750
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7	20	Allis-Ch. ..	220		750
2	20	G.E.	440	K	750
1	40	Wstgh. . .	220	MW	695
1	50	Allis-Ch. intermittent duty, sl. rg. drum controller	440		500
1	55	Wstgh.sl.rg. 30 cycles, complete. .	440		860
1	60/45/30	G.E.	440		500 375 250

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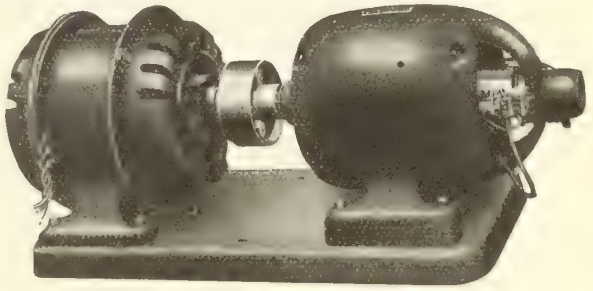
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and Engineering Review

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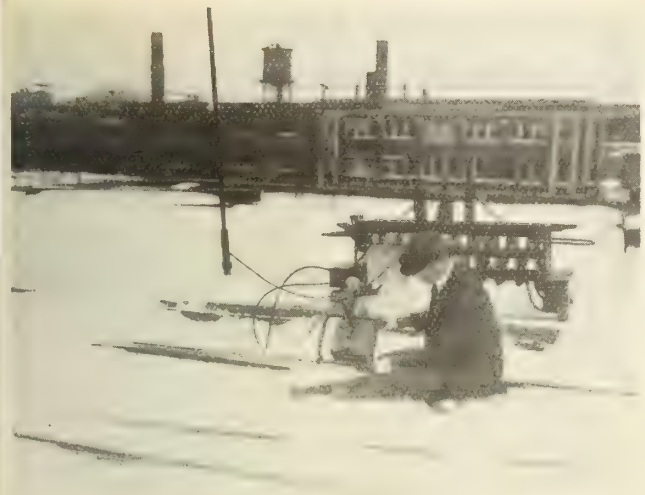
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Bitumen protective paint, elastic, acid-resisting, weatherproof.

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The Rheostat shown above weighs 140 pounds, and the Welder weighs 65 pounds. The outfit installs standard ERICO Rail Bonds, and will operate on voltages between 250 and 750.

No flame or arc strikes bond or rail.

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include a complete line of bare and insulated electrical conductors for all classes of service, also cable accessories. We also manufacture copper, and brass tubes and rods, extruded brass shapes, etc. We are in a position to serve all users of these products to good advantage.

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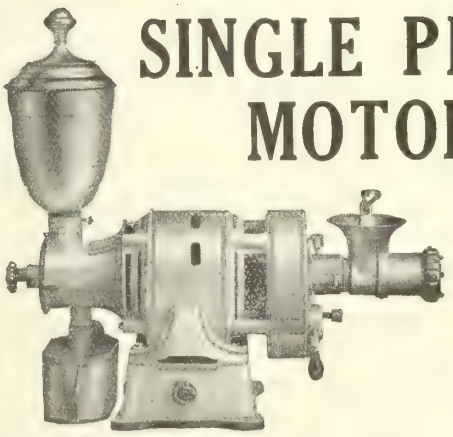
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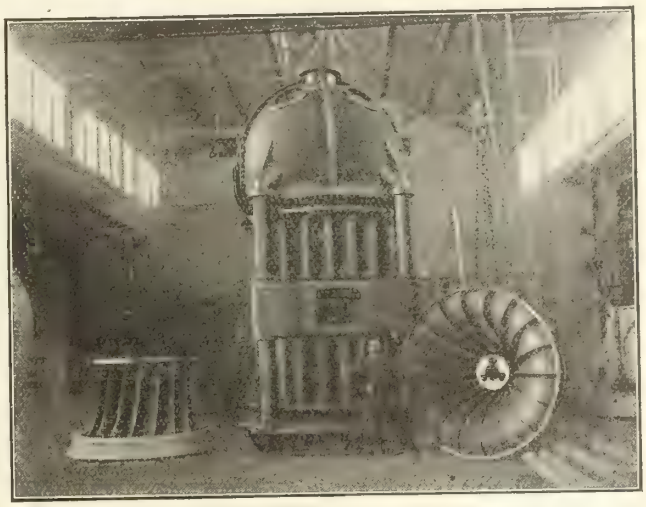
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High Efficiency Pumps



Vertical Turbines

shown in the accompanying illustration were designed and manufactured by us for the Hydro-Electric Power Commission of Ontario. They are among the largest water turbines installed in Canada and are characteristic of the high efficiency of our engineering department.

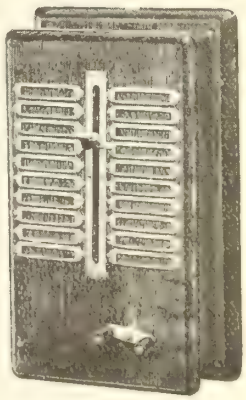
The services of these experts are at your disposal to consult on any of your engineering troubles.

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in a plant is also easy after you have installed a Presto-Call System. The Presto-Call is a Signal Service that we make in three sizes to call 5 men, 10 men or 20 men. It is easy to operate, and moderate in price; works with either vibrating or single stroke bells, or horns. The Presto-Call pays for itself in a few months.

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(Continued on Page 46)

SQUARE D
STEEL ENCLOSED SWITCHES

An Ounce of Prevention—

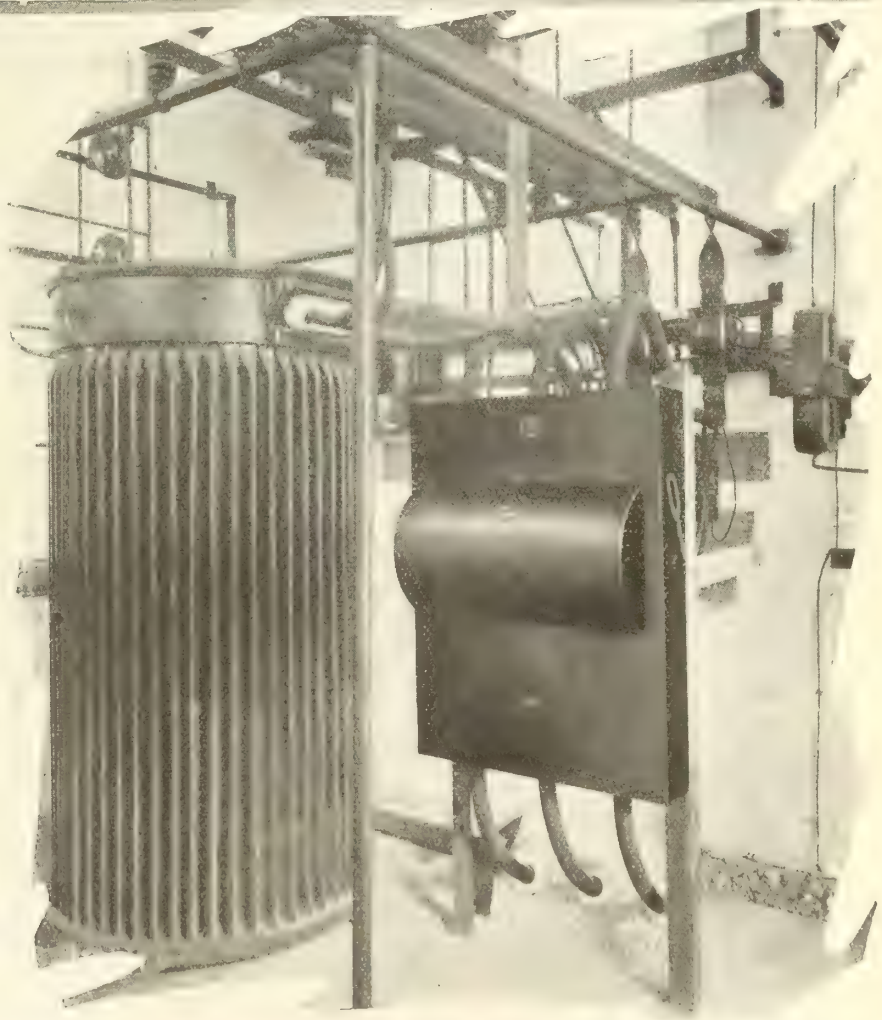
Whenever an accident, that could have been prevented, occurs in your shop, the loss incurred by waste of time, expensive repairs and discounted good-will of your men far exceeds the cost of the measure that would have prevented it.

Square D Switches cost but little more than the old-fashioned open knife switch, and they afford triple protection:—complete enclosure of all live parts protects the men; the lock-off device protects both men and equipment; quick and positive action insures the service.

The Square D Steel Enclosed Switch is an investment that is paying a double return—saving and peace of mind in industrial plants ranging from the largest to the smallest shops. The saving effected is amazing. *Ask your electrician.*

SQUARE D COMPANY, Walkerville, Ont.

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THE ORIGINAL SAFETY SWITCH

SQUARE D SWITCHES
do not hinder production

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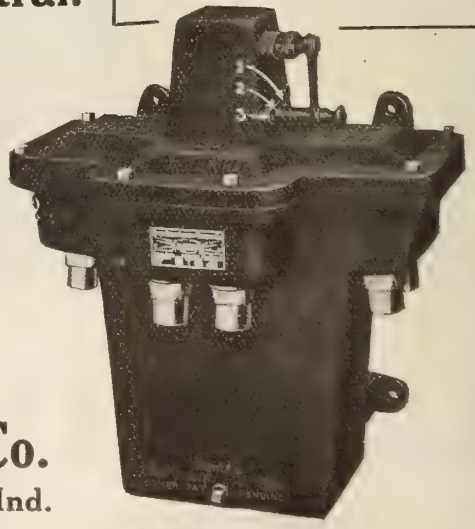
Is now local as well as central.

A new combination lever attachment enables watchmen to close the switch by hand in daylight or night hours to locate burnt-out lamps, or to avoid outages on load controlled by the switches while clearing series troubles. The switches may be cut out of service where White Way Systems are on only on Saturday nights, special occasions, etc. If put out of step by lighting, etc., they can be stepped ahead.

This refinement broadens the scope of usefulness of the R-C-O-C equipment.

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At the power-house, using the regular series street circuit for the control wire, the operator controls series White Way systems having combinations of all-night and short-hour lamps on the same circuit, or multiple White Way systems, having all-night or combination all-night and short-hour lamps on the same circuit; or bridge, alley, sign, pump-motor circuits; or (a most important point) pole type or subway Constant Current Transformers, controlling loops of series-circuits. Watchmen, patrolmen, time switches, and irregular lamp hours are things of the past in R-C-O-C installations.



The New 2-in-1 Case

Subway or Pole Type R - C - O - C Switches may now be obtained in our new 2-in-1 case. This is a point to be remembered where manhole space space is limited, because two switches in the new case take up little more room than the single switch case, conserving space and weight on pole line installation.

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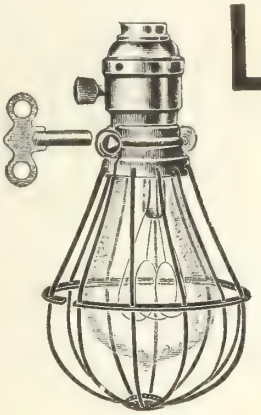
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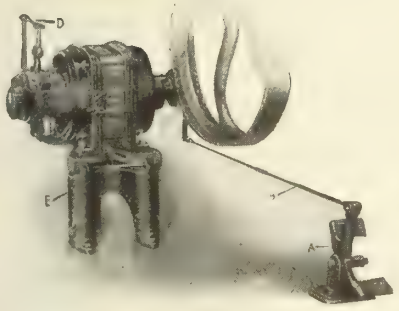
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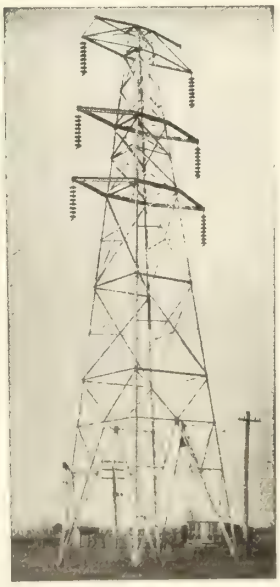
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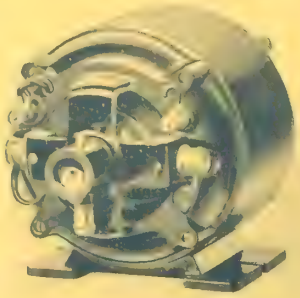
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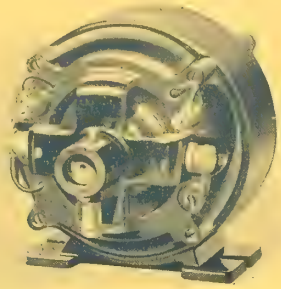
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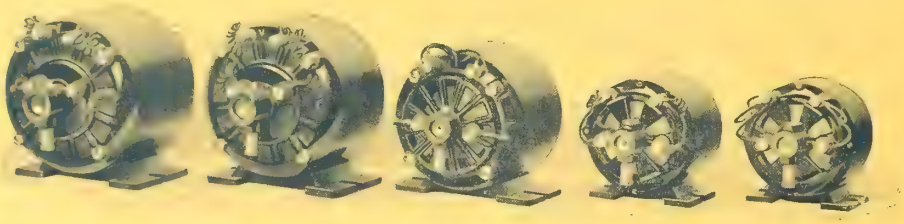
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Continuous Service. Single Phase.
25 Cycles.

H.P.	Speed Synch. R. P. M.	Frame No.	Code	Shipping Weight
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1/3	1500	A-4	Cure	62
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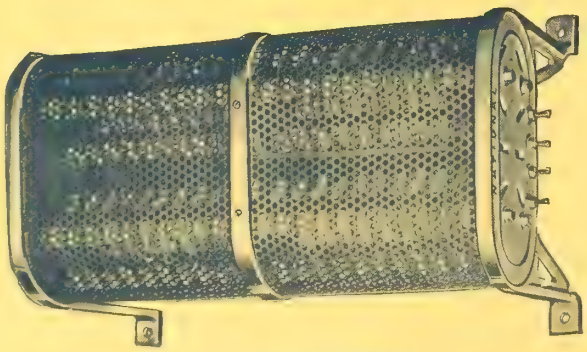
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Vol. XXVII No. 9 Toronto, May 1, 1918

Electrical News

Generation, Transmission and Application of Electricity

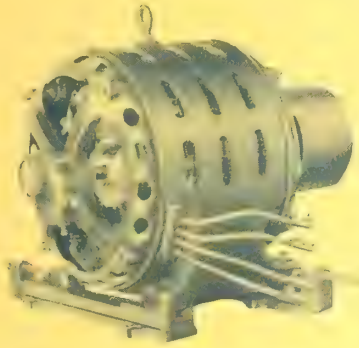
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CONDIT

Oil Switches and Circuit Breakers

TYPE D-13

Maximum Amperes, 800 **Maximum Volts, 25,000**

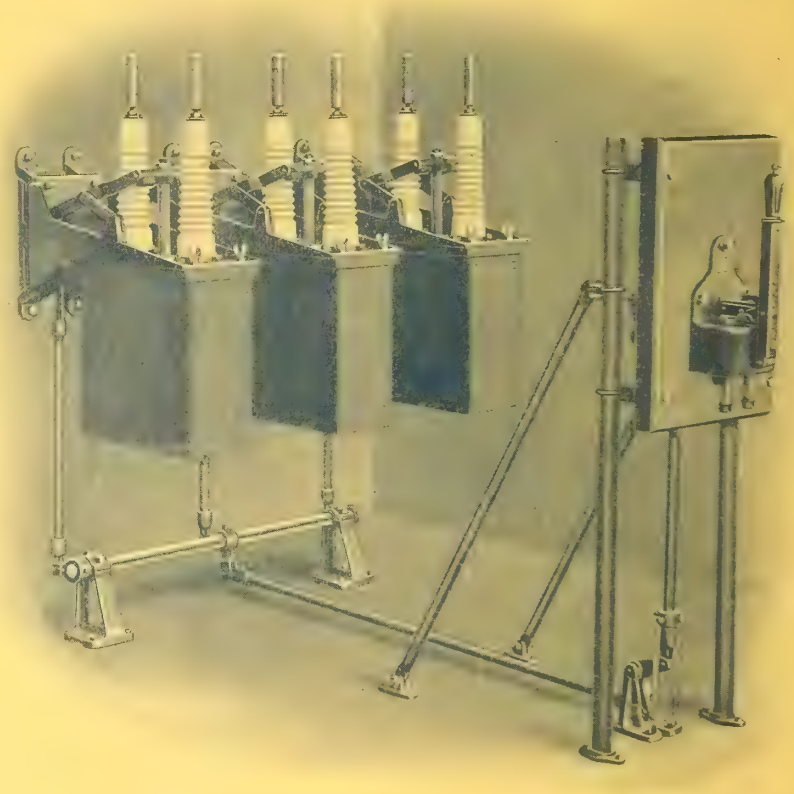
APPLICATION

D-13 oil switches and circuit breakers are used for controlling and protecting generators, feeder circuits, transformer banks, etc. Their sturdy construction, high factor of insulation and ability to interrupt large amounts of energy, makes them highly desirable for controlling and protecting apparatus and circuits where uninterrupted service is of extreme importance.

CONDIT D-13 oil switches and circuit breakers are made in single, two, three and four poles, for manual remote control or electrical operation. They are furnished in 300, 500 and 800 ampere capacity for pressures of 15,000 volts or less, and for capacities of 300 and 500 amperes where the pressure does not exceed 25,000 volts.

CONSTRUCTION

All automatic forms of type D-3 oil switches and circuit breakers may be provided with undervoltage, shunt-trip and time-limit attachments in any combination. Overload types have their trip coils and calibration adjustments on the front of the switchboard, and the mechanism is arranged to prevent the operator from holding the switch closed during an overload or short circuit. The handles drop automatically to the open position when the circuit breaker opens, thus visually indicating the open position of the switch.



MANUALLY OPERATED—REMOTE CONTROL
25,000 Volts—300 Amperes

For the complete story of CONDIT Type D-13 Oil Switches and Circuit Breakers get Bulletin No. 419. Tells fully, yet concisely, everything you want to know about the application, construction and installation of this equipment together with valuable facts relative to attachments and accessories. Also includes important data on dimensions, cell construction, and standard arrangements for either manual or remote control. All CONDIT Bulletins should be in the files of every up-to-date engineer. Write our nearest house for copies.

Full details in Condit Bulletin 419

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Coffee Percolators



Coffee Percolator. Pot Style. No. 11793. Holds 7 cups or 2½ pints. Finished in nickel; comes with cord and attachment plug complete.



Urn Style, No. 12793. Graceful and ornamental. Finished in nickel; holds 7 cups or 2½ pints; comes with cord and attachment plug complete.



Pot Style, No. 11493. Holds 8 cups or three pints; finished in nickel; comes with cord and attachment plug complete.

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Toasters, Irons and Chafing Dishes



N. E. B130 Toaster. Upright open Toaster, finished in nickel; comes with cord and attachment plug complete.

N. E. B142. Handsomely designed Chafing Dish. Holds three pints; finished in nickel; comes complete with cord and attachment plug.



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We ship promptly.

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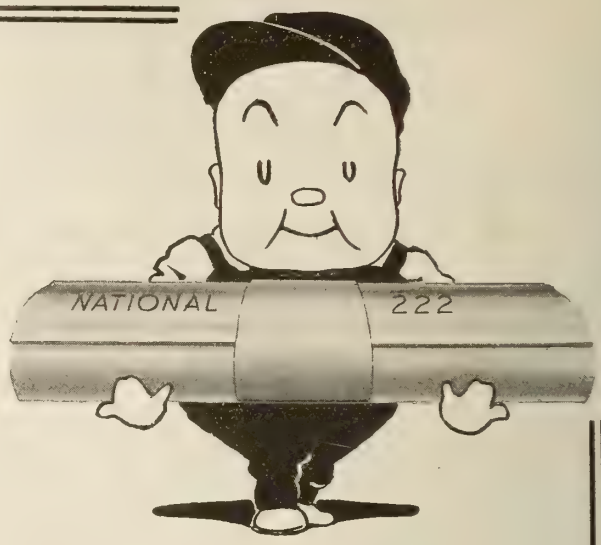
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Lowest Installation Cost of Any Metal Wiring System. Try it on your next job and see for yourself.

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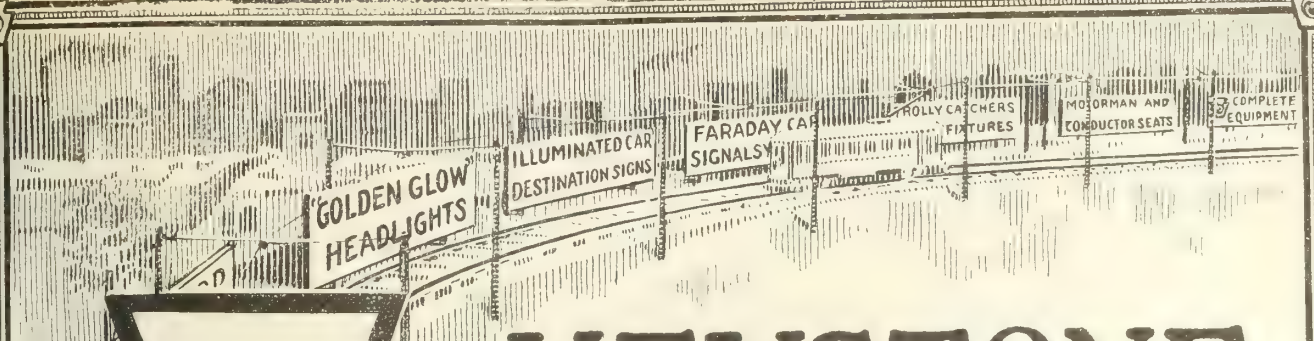
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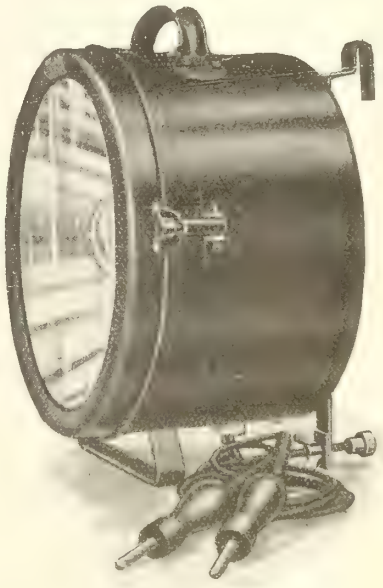
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Your patrons, better than anyone, realize the safety value of efficient headlights.

The bright, illuminated sign is always an inducement to ride.

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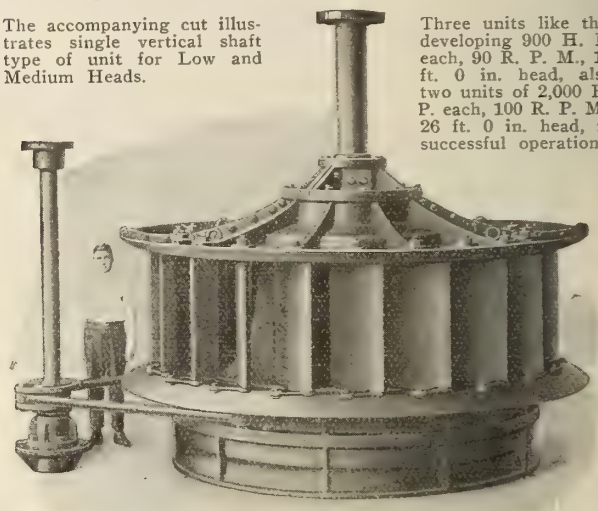
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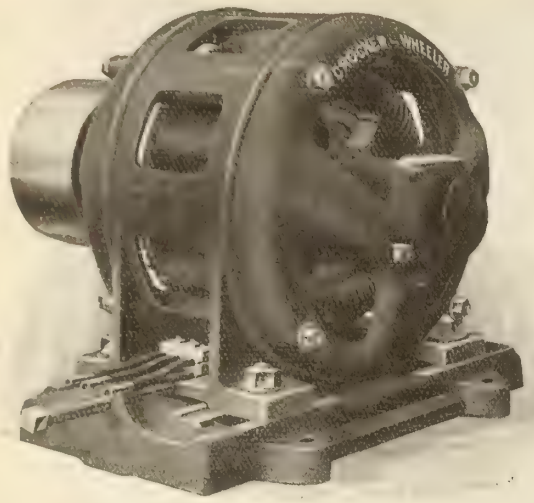
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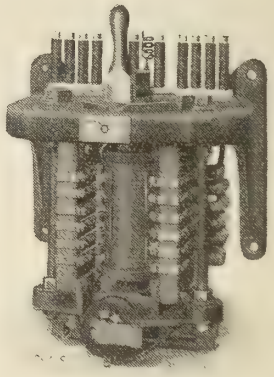
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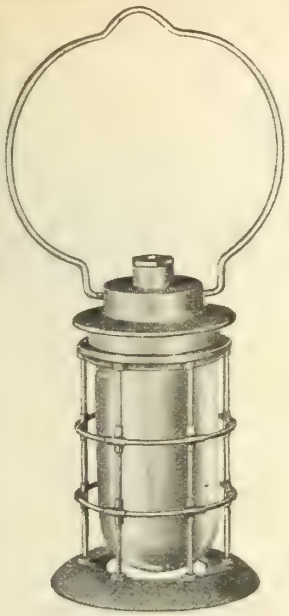
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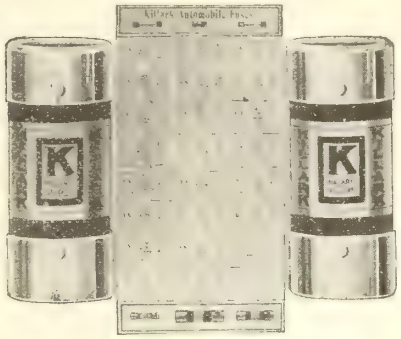
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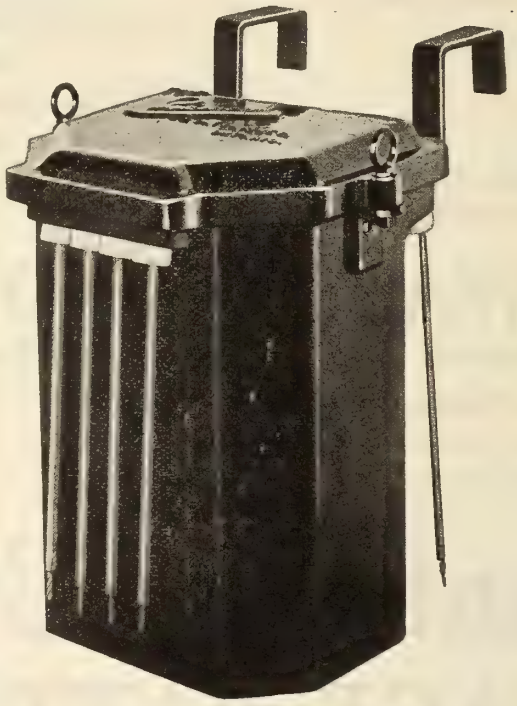
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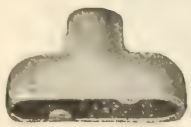
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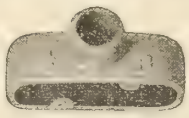
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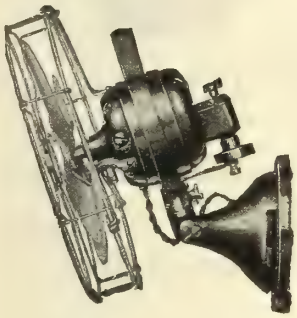
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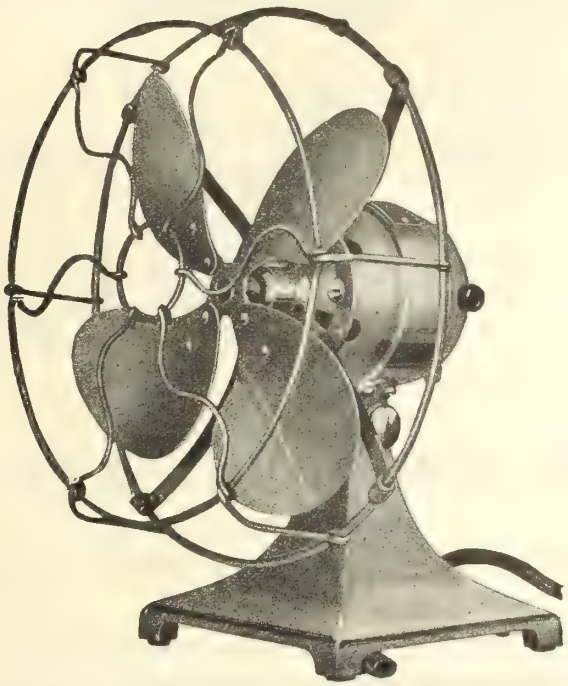
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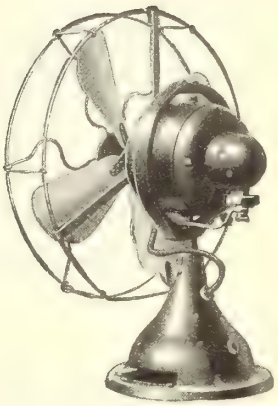
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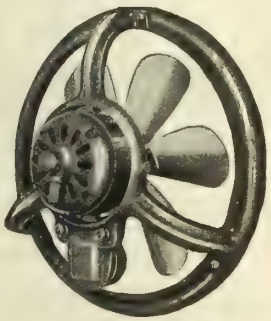
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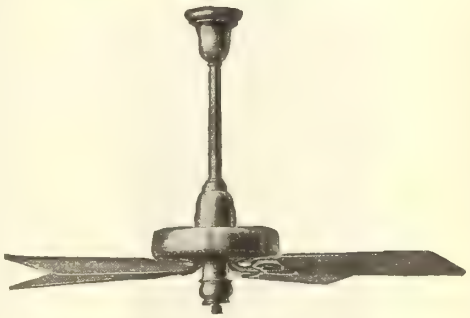


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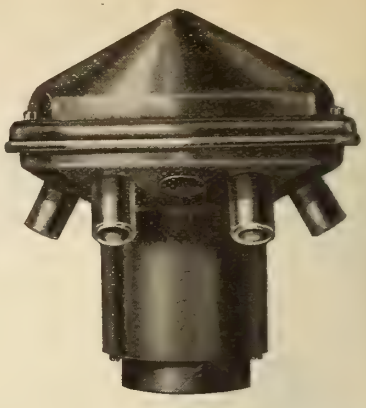
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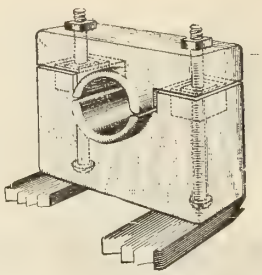
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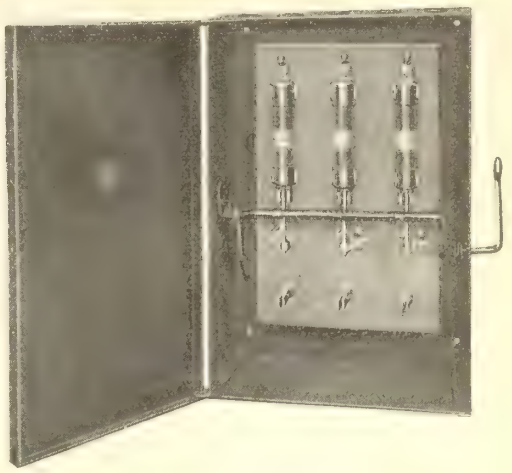
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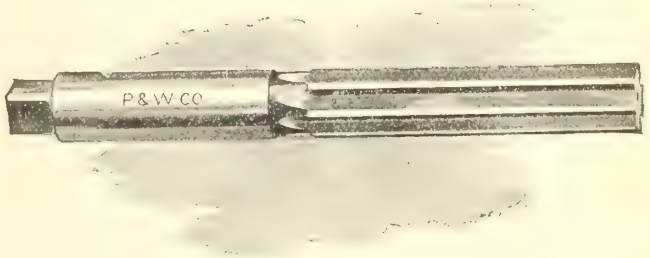
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A Laboratory Manual of Alternating Currents, by John H. Morecroft, E.C. Published in 1912 by Renouf Publishing Company. 248 pages, illustrated. Price $2.00.

Alternating Currents—Examples for Students and Engineers, by Prof. F. E. Austin. Second edition, Vol. I. Published in 1916. 223 pages, illustrated. Price $2.40.

Baudot Printing Telegraph System, by H. W. Pendry. Published in 1913 by Whittaker & Company. 144 pages, illustrated. Price $1.00.

Direct-Acting Steam Pumps, by Frank F. Nickel. Published in 1915 by McGraw-Hill Book Company. 258 pages, illustrated. Price $3.00.

Direct Current Machinery, Theory and Operation of, by Cyril M. Jansky, B.S., B.A., 1st edition, just published by McGraw-Hill Co., Inc. 285 pages, illustrated. Price $2.50.

Dynamo-Electric Machinery, by Francis B. Crocker, E. M., Ph.D. Published in 1908 by American School of Correspondence. 236 pages, illustrated. Price $1.00.

Electric Arcs, by Clement D. Child, Ph.D. Published in 1913 by D. Van Nostrand Company. 194 pages, illustrated. Price $2.00.

Electric Car Maintenance, by Walter Jackson. Published in 1914 by McGraw-Hill Book Company. 274 pages, illustrated. Price $2.00.

Electric Cooking, Heating and Cleaning, by Maud Lancaster. Published in 1914 by D. Van Nostrand Company. 330 pages, illustrated. Price $1.50.

Electrical Machinery—Principles, Operation and Management, by Terrell Croft. Just published by the McGraw-Hill Book Co. 318 pages, illustrated. Price $2.00.

Electrical Meters, by Cyril M. Jansky, B.S., B.A. Second Edition, just published by McGraw-Hill Book Company. 416 pages, illustrated. Price $3.00.

Electric Railway, by A. Morris Buck, M. E. Published in 1915 by McGraw-Hill Book Company, Inc. 390 pages, illustrated. Price $3.00.

Electric Railway Engineering, by C. Francis Harding, E. E. Second Edition. Published in 1916 by McGraw-Hill Book Company. 416 pages, illustrated. Price $3.00.

Electrical Injuries, by C. A. Lauffer, M.D., published in 1912 by John Wiley & Sons. 77 pages. Price 50 cents.

Electro-Dynamics, by Charles Ashley Carus-Wilson. Published in 1898 by Longmans, Green & Company. 298 pages. Price 50c.

Elementary Principles of Illumination and Artificial Lighting, by Arthur Blok, A.M.I.E.E. Published in 1914 by Scott, Greenwood & Son. 235 pages, illustrated. Price $1.00.

Elementary Graphic Statics, by John T. Wight. Published in 1913 by Whittaker & Company. 226 pages, illustrated. Price 75c.

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Engineers' Manual, by Ralph G. Hudson. Just published by John Wiley & Sons. 315 pages, illustrated. Price $2.00.

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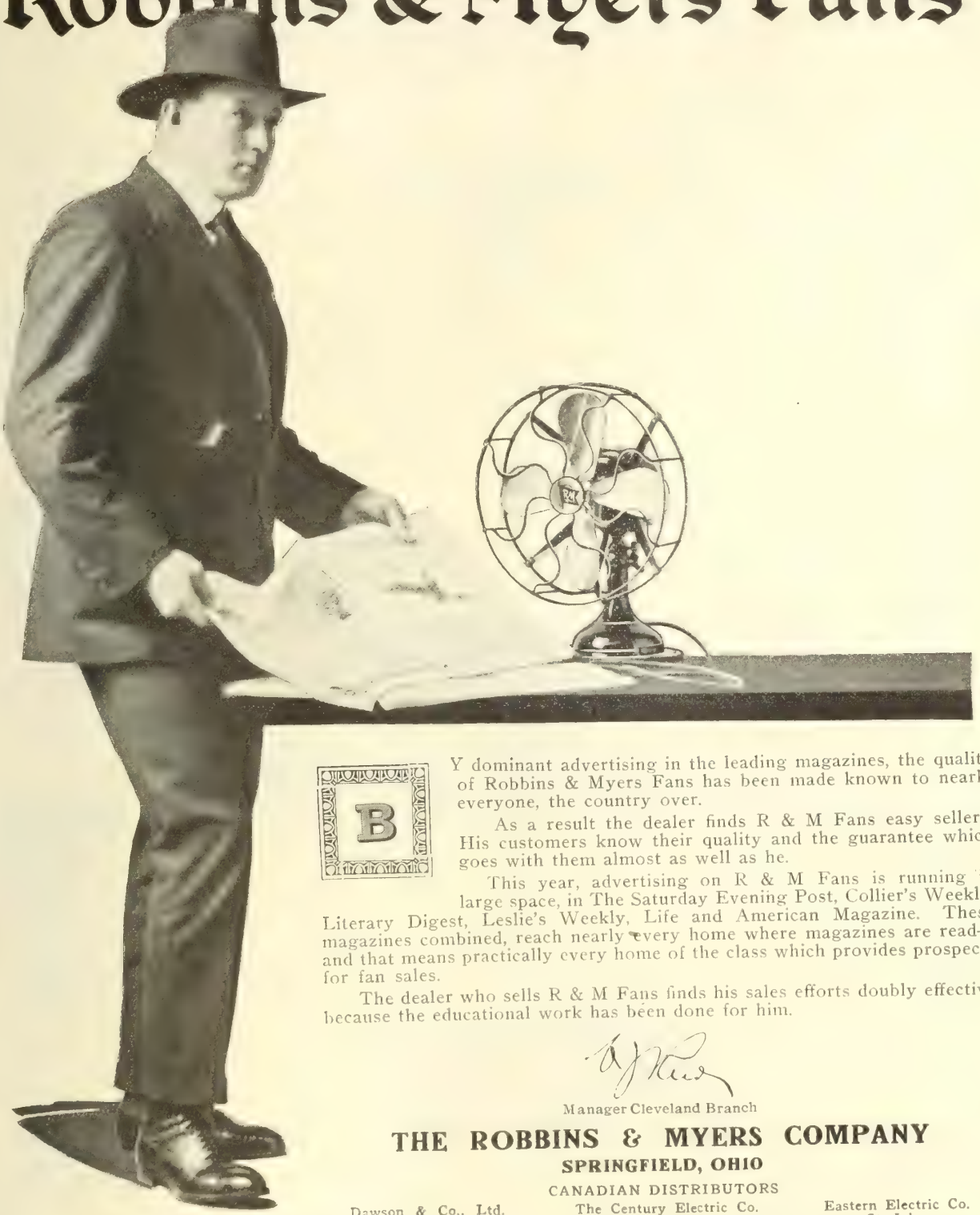
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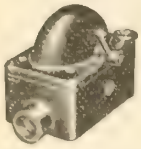
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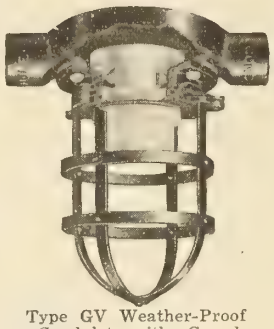
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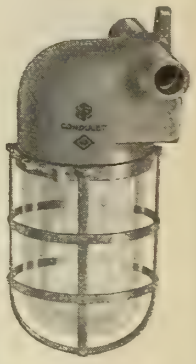
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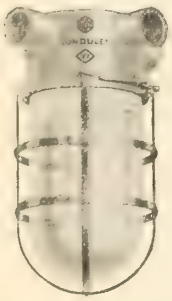
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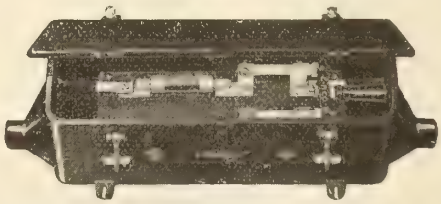
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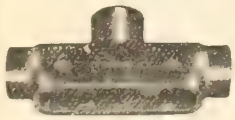
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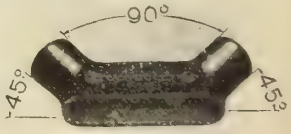
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Will the War be Followed by Concerted Effort for the Common Welfare?

The talk at the Montreal Electrical Luncheon on April 3 was of a different character to any other given this season. The speaker was Ex-Recorder Weir, and his address, with the somewhat ambiguous title of "Whither Are We Drifting," dealt with present-day social and economic questions, with particular reference to the manifesto of the British Labor party, a document which has been widely published in Great Britain and on the North American Continent.

There was, said the speaker, a growing feeling of what he termed social consciousness—a feeling that the present condition of society was not the best possible, and that our civilization was not the best possible. The minds of men were asking for something better. This craving for better conditions had characterized all history, and it would continue for all time. In England the policy of laissez-faire had been advocated by such eminent men as Bright and Cobden, who deprecated factory legislation on the ground that the government had no right to interfere between men and employers; but that idea had gone by the board and had been succeeded by a policy of socialism, which had been accentuated by the war. In England there had been a pastoral age, an agricultural age, a commercial age, and an industrial age, the latter accompanied by a number of social problems.

Instead of the laissez-faire policy there was a tendency for the government to control various matters, and he instanced old age pensions as one of the questions dealt with as the outcome of the socialist policy. In our day there was a feeling that men who labored with their hands or brains, or with both, should be animated with the idea of working for the common good, and the British Labor party in their manifesto distinctly included men who worked with their hands and those who worked with their brains. The old scramble by individuals was becoming obsolete. Just as in the war the people had been animated by a common spirit for patriotic purposes, so in the economic field there should not be a scramble for individual prosperity, but a concerted effort for the common welfare.

The speaker concluded by enumerating the main points of the British Labor manifesto, incidentally mentioning that the Canadian Government ought to materially extend their efforts to find employment for the returned soldiers.

Public Interest Best Served by Delaying Underground Work

The city of Montreal has failed in its application to the Quebec Public Utilities Commission to compel the Montreal Light, Heat, and Power Consolidated, Montreal Public Service Corporation, and Montreal Tramways Company to place their wires, cables, etc., in certain underground conduits in the down-town district built by the city, and to remove the wires and poles from the streets. The city issued instructions for the companies to use the conduits, but as these were not complied with, an application was made to the Utilities Commission. The companies replied that it was unreasonable to ask for this work to be done, having regard to the difficulty and cost of obtaining supplies.

The judgment of the commission is that the service to the public will not suffer by allowing present conditions to remain, and that there was evidence of the severe restrictions upon the supply of the necessary material, due to war conditions. "It is beyond all question," continues the finding, "that the expense involved in doing the work required would be greatly in excess, apparently 100 per cent., of that occurring in normal times."

In the opinion of the commission, the compelling of the work would not be commensurate with the sacrifice entailed by its immediate achievement, even if that were possible. "The public interest would be best served by deferring the work to be done until such time as present conditions shall have altered. The application is not allowed for the present. It is, however, to be distinctly understood that the finding goes no further than merely suspending the work to be done for the time being." The rights of the city are still maintained, including that of a renewal of the application at any time it may deem proper.

Conserving Fuel in Montreal

With a view to conserve fuel, the Montreal Light, Heat, and Power Consolidated and the Montreal Tramways Company have made an agreement under which the former will supply the Tramways Company with additional hydro-electric power, thus restricting the use of coal for the Tramway Company's steam plants. The agreement was due to the efforts of the fuel controller, who brought the companies together. The arrangement will continue for 18 months, and is estimated to save about 37,000 tons of coal. The Tramways Company is supplied with a certain amount of power, under agreement with the Montreal Light, Heat, and Power Consolidated, but the peak load, at the busy hours, is taken care of by the Tramways Company's steam plants, a new plant having been recently installed.

The new agreement is on a meter basis, and is likely to call for about 10,000 h.p. per annum, and may possibly be larger than these figures. The great object is to save as much coal as possible, involving a minimum operation of the Tramways Company's steam plants.

The contract, of course, means an additional call on the

resources of the Power Company. The two new units at Cedars will probably be ready in three months, so that the company will then be in a position to more than cover the larger requirements.

The demand for power in the province is increasing, largely for manufacturing purposes. Many new industries have been, and are being, located in the province, due to the facility with which cheap and abundant power can be secured. The power companies are making every effort to meet this demand and also to provide for future requirements. Besides the addition to the Cedars plant we have the important development of the Southern Canada Power Company at Drummondville and the contemplated addition of two units by the Laurentide Power Company.

The Power Controller's Latest Order Helps the Situation

Mr. Drayton has somewhat cleared the Ontario power horizon by his latest order, which virtually amounts to a pooling of all the power generated at Niagara for distribution throughout Ontario. In addition he has made arrangements with the private companies concerned for the operation of their steam plants at Toronto and London, guaranteeing certain protection to these companies against the abnormal cost of coal and the difficulty of obtaining it. Such action will appeal to the general public as in the best interests of those industries which are most necessary for the prosecution of the war.

It is not evident on the surface whether the Hydro or the private companies stand to gain (or lose) most by this pooling arrangement. Generally speaking, the greatest advantage would appear to accrue to the side on which the need for more power was the most urgent The main point at issue, however, is that all the power we can possibly render available is now to be applied at strategic points in the most effective manner.

High Tension Phenomena at the A.I.E.E.

One hundred and ten members of the Toronto section of the A.I.E.E. were privileged to see actual demonstrations of testing at 250,000 volts, the use of the sphere gap for measuring high voltages, and the formation of corona, at the Hydro Laboratories last Friday. The occasion was a paper by Mr. W. P. Dobson on "High Voltage Phenomena," and the experiments contributed to the attractiveness of the subject. In Mr. Dobson, it was clear, the section boasts a member who is a physicist of considerable attainments and a mathematician of a high order. The paper, which was devoted to high voltage measurements, the corona voltmeter corona losses, and the effects of switching on high tension lines, showed great thought in its preparation and a careful study of the work of recent investigators of the subject. An interesting test demonstrated the reliability of the sphere gap in comparison with the needle gap for measurement at different frequencies. This paper indicates that much good work is being accomplished in the commission laboratories in the direction of standardization and research at high voltages.

The Open Boat

"When this here War is done," says Dan, "and all the fightin's through,
There's some'll pal with Fritz again as they was used to do;
But ***not me,"*** *says Dan the sailor man,* ***"not me,"*** *says he*
"Lord knows its nippy in an open boat on winter nights at sea."

"When the last battle's lost an' won, an' won or lost the game,
There's some'll think no 'arm to drink with squareheads just the same;
But ***not me,"*** *says Dan the sailor-man, "an' if you ask me why—*
Lord knows its thirsty in an open boat when the water-breaker's dry."

"When all the bloomin' mines is swep' an' ships are sunk no more,
There's some'll set them down to eat with Germans as before;
But ***not me,"*** *says Dan the sailor-man,* ***"not me,*** *for one—*
Lord knows it's hungry in an open boat when the last biscuit's done."

"When peace is signed and treaties made an' trade begins again,
There's some'll shake a German's hand an' never see the stain;
But ***not me,"*** *says Dan the sailor-man,* ***"not me,*** *as God's on high—*
Lord knows it's bitter in an open boat to see your shipmates die."

—C. F. S. in "Punch"

The Application of Education to Industry

An Address Delivered before the Annual Meeting of the Joint Committee of Technical Organizations, Ontario Branch

By Col. David Carnegie*

Before referring particularly to the subject I have chosen for consideration this evening, I think you will be interested to know that since the formation of the Inventions Committee of the Imperial Munitions Board in February, 1917, we have examined approximately 500 proposals, sent from all parts of Canada and other countries. The following gives the number of proposals from each province in Canada and from other countries:

Inventions, March 19, 1918—Total Proposals Received to Date, 543

Ontario	223
Quebec	46
Manitoba	12
Saskatchewan	30
Alberta	27
British Columbia	28
New Brunswick	6
Nova Scotia	22
Prince Edward Island	2
Newfoundland	1
Yukon	1
United States	129
England	4
Australia	1
New Zealand	1
France	2

Out of these we have forwarded 32 proposals to the Inventions Board in London.

One inventor sent as many as eight different inventions. The proposals have related to aeroplanes, protection of ships from submarines, designs of guns, shells, bombs, aerial torpedoes, tanks, and many other minor warlike subjects. Prior to the formation of our committee inventors knew of no particular department of government where to send their proposals for consideration, and no particular department had any specific organization formed to examine carefully the proposals submitted. We have on our committee representative members of the military and naval services of the Government of Canada, the universities, and technical societies, all of whom are voluntary workers. We have also the assistance of the Patents Office staff and other departmental branches of the Dominion Government where the proposals submitted require the investigation of specialists in their departments.

We think that the work of the Inventions Committee, although it has taken very little time from the regular duties of the officers of the Imperial Munitions Board, has served a very important purpose, and has awakened and developed many latent faculties. Evidence of genius has been marked, but the need for its direction and instruction in the elementary principles of science have been revealed in many of the proposals. It is because I believe that your society, consisting of technically trained men coming from different industrial centres in Canada, can be of great service in educating and directing the untutored that I have ventured to offer to you this evening some suggestions regarding the education of the industrial worker, the skeleton of which I presented to the members of the Canadian Mining Institute recently when dealing with "Some Problems in the Readjustment of Industry." I wish, therefore, to confine my remarks this evening to the functions of the educational committees of production boards for each industry, or of any other body organized with the same object.

*Member and Ordnance Adviser, Imperial Munitions Board, Ottawa.

The Functions of Educational Committees of Production Boards

In the address to which I have referred I suggested the formation of production boards for each industry, consisting of equal numbers of the representatives of the employers and employees in the district. The functions of these boards included, among other important duties, the education of industrial workers, as follows:

1. The vocational training of the child in preparation for his entry into industry.
2. The education of the actual producer (principally manual).
3. The education of the directors of production (both manual and technical).
4. The education of the distributors of production (principally financial and commercial.)

It might be advisable to look at the fundamental principles underlying industrial education before considering what might be the best kind of education.

Fundamental Principles Underlying Industrial and Technical Education for Each of the Classes Enumerated

The question might be asked: What is the object of our pursuits? Are we simply setting out to train humanity from childhood to become efficient producers in the world of industry? This would, indeed, be a worthy aim. Organized education in industry is surely better than systemless education and chaos. But that is surely not the only, or principal, object. I believe with Ruskin that "The entire object of true education is to make people not merely do the right things, but enjoy the right things; not merely industrious, but to love industry; not merely to learn, but to love knowledge; not merely pure, but to love purity; not merely just, but to hunger and thirst after justice." I am sure you will agree with me that these objects should underlie industrial and technical education, as well as every phase of education. It is not merely sufficient to turn out well-equipped and efficient workers in every class of industry most fitted to their natural bents, but to seek to make each worker discover the wholesomeness and happiness in the performance of every task, interpreting his experience in terms of pleasurable duty, which will bring not only personal gain, but will add to the interests of the community and nation. "No pleasure," says Bacon, "is comparable to the standing upon the vantage ground of truth." The great fundamental principle, therefore, underlying all education is truth—"truth in the inward parts."

Classes to Be Educated in Industry

Considering, then, the education of the human forces in industry we have: (1) The juvenile at school and at work; (2) the adult worker; (3) the director of production; (4) the distributor of production.

I wonder if a fifth class should be included—a class to provide the program of education? It is conceivable that our teachers may have misinterpreted the true fundamental principles underlying industrial education. It may even be necessary to break the moulds in which our teachers have been cast. In the light of present knowledge, I do not agree with Emerson when he says in that beautiful essay on compensation: "There is a crack in everything God has made," but if the exhibition of savagery in Europe for the past three and a half years is the outcome of the highest culture in science and art, surely science and art have been prostituted to fiendish

uses, or we are misguided in our interpretation of experience and the lessons learned therefrom, and there must be more than a crack in our man-made culture.

Are Our Standards and Goals Right?

If the world's higher education in the intellectual and industrial pursuits has led the people into such inhuman strife, is it unreasonable to suggest that we pause and consider whether anything is wrong with our standards and measures, or is all this slaughter the outcome of their wrong uses? Have we been listening to false prophets about the glory of that land which will be plowed by the most efficient machinery; where the labor of sowing and reaping will be reduced to a minimum? Do we see before us a culture and genius which will transform with a minimum of effort the raw materials of the earth's surface, bringing with them a wealth and ease which our tired bodies and hungry souls long for? Have we yet discovered that "man shall not live by bread alone"? Are we lowering the standard of manhood by the kind of goals we have set ourselves? There are other goals beyond the gold fields; beyond the money values of industry. If "man's chief end is to glorify God and enjoy Him forever," then our standards of culture which lead us from that end are unholy. All the cruelty, intrigue, disloyalty, and avarice, so rampant in the world, and particularly in cultured Germany, indicate a self-inflicted deformity of God's image, which it was man's proud fortune to possess. If the horrors of war are arresting our thinkers and opening new vistas of unexplored mind where spirit values instead of material values count in the true adjustment of our industrial affairs, there shall evolve from the carnage and scientific barbarism a new era in which a true interpretation of the loathesome experiences through which we have passed will bring out the value of the fundamental principles upon which our industrial education must be built. We shall then discover the principle underlying education which will give the worker the opportunity of maintaining efficient service with a maximum of enjoyment.

Ability and Interest Essential to Efficiency

In the suggestions I am about to make I recognize the futility of obtaining sustained, efficient service from any class of worker, either by hand or brain, unless the worker has discovered a pleasure and interest in his employment. I believe that the co-operation of these two great human forces—ability and interest—are absolutely essential to effective service.

1. Vocational Training of Children for Industry

For the past four years there has lain upon the shelves of Canada's bookcases one of the most comprehensive reports ever made upon industrial training and technical education. I could not refer any educational committee of production boards or similar organizations to better plans for their consideration than those recorded therein. Dr. Robertson, who was the chairman of the commission appointed by the Dominion Government to investigate the scope and nature of industrial training and technical education in Europe and America did not only record the facts and make recommendations to the Dominion Government concerning their application to Canada, but has never lost an opportunity of emphasizing the need of puting the recommendations of the commission into practical operation.

The People of Canada Desire Industrial and Technical Education

Dr. Robertson's report says that Canada does not only require such education, but longs for it. One thousand, four hundred and seventy-one men and women in Canada, representing the industrial, business, agricultural, home-making, and technical work of the Dominion, witnessed to the commission their anxiety to have better industrial and technical education for Canada.

Benefit of Vocational Training in Other Countries

Dr. Robertson's report also shows that great advancement has been made in industry in England, Scotland, Ireland, Denmark, France, Germany, Switzerland, and the United States by the addition to elementary education of manual training, domestic science, nature study, and school gardens. Children leaving school at 3 or 14 years of age are transferred at the age of 11 or 12 years to classes having what is called an industrial bias, commercial bias, and housekeeping bias, where a definite time is set aside for such education. Trades are not taught at such schools, neither do these classes displace general education from books. They are known as "elementary courses,' 'and have developed at an extraordinary rate in England and Europe. In Scotland, for instance, ten years prior to the war there were 162 schools, with 3,281 pupils, and in 1913 there were 1,945 such schools, with an attendance of 43,281 pupils.

Dr. Robertson's Proposal Has Provided a Program

It is not my object now to propose any detailed program for the vocational training of the child. My object, rather, at present, is to point to the source of information where well-considered thought has been given already to the subject, and to seek to indicate how the application of such plans to each industry could be established by the aid and harmonious co-operation of the producers in each industry and the educational authorities.

Co-operation of Educational Committees and School Authorities

The Educational Committee of the Production Boards, for instance, could work in the closest association with the management committee of the school authorities of each district, with a view to the selection and preparatory training of the children required periodically for each industry. Such selection would be made having in mind always the aptitude and interest of the child in the class of work to be followed. I am informed that in connection with the examination of school children in Australia phrenologists are employed by the government to discover the direction of their bent for industry.

By the co-operation of educational committees of production boards with the school authorities they could determine:

1. The nature and duration of training most suitable for boys and girls in the schools.
2. What partial attendance at schools and works was necessary during the earlier stages of industrial training.
3. The number of hours for study, manual labor, and recreation.

Duties of Educational Committees

The duties of the educational committees of production boards would also include the preparation of the courses of training in the works for juveniles; the number of hours for such training; periodic examinations, with a view to discovering progress in interest and enjoyment in the work as well as ability; the issue of certificates showing the standard attained in the particular branch of the industry; the consideration of rates of remuneration for each child during the period of training, and also the provision of suitable conditions for the welfare of the children.

2. The Education of the Actual Producers

Although it has been said frequently that there is little hope of educating more than an insignificant percentage of the large number of men and women once they have drifted out of boyhood and girlhood, there are many signs which encourage the hope that not an insignificant percentage of the workers are craving for knowledge and right leadership. Educational authorities have done a great work in providing continuation classes for general training in industry and in

arranging classes for special study relating to classified industries.

Technical Instruction in Works

These advantages are emphasized in the report of Dr. Robertson, to which I have already referred. They could be supplemented by making provision for the instruction of adults in districts where no schools exist, by the formation of classes for instruction by qualified teachers, many of whom could be found in the ranks of the industries over which production boards preside. Many of the foremen, superintendents, draftsmen and chemists could give manual and technical education in the tending of machines, the use of gauges, moulding, plumbing, blacksmithing, drawing, chemistry, etc. Certificates of qualification could be issued after a definite period of instruction and proved ability and interest. Such classes could be made so attractive that all branches of labor would be encouraged to qualify for a higher grade. The shop or yard sweeper, for instance, would have the chance of qualifying for any position requiring the highest skill in operating.

Workers' Educational Association

Perhaps the most encouraging sign of educational progress of recent years is the great movement begun by the workers themselves for the education of the adult worker, and known as the "Workers' Educational Association." It was founded in 1903 in England by a group of trade unionists, co-operative, friendly, and educational societies, and aimed "at nothing less than the restoration of education to its rightful place among the great spiritual forces of the community."

This association, pioneered by the industrial workers, joined hands in 1907 with the universities at a national conference which was held at Oxford, where seven representatives from the universities and seven from the representatives of labor formed themselves into a joint committee for the establishment of what is known as the "University Tutorial Class System." Every university in England to-day has its joint committee for tutorial class work, consisting of an equal number of university and working class representatives. A great alliance, therefore, has been formed between the sources of education and the organized working classes.

The story of the development of this work is most entrancing. In 1914 there were 2,555 affiliated societies, scattered over England and Wales. I believe that the educational committees of production boards would be able to obtain considerable help from the study of operations of the W. E. A. to enable them to formulate plans for classified education, particularly in districts where technical schools were not available.

2. Practical Training of Adult Labor

Many facilities during recent years have been offered to the adult worker in industry to improve his practical knowledge of his craft. Quite recently I received a description of a training school for employees, organized by the Recording and Computing Machine Company, of Dayton, Ohio. It had for its object the training of raw labor, men and women, to work to the closest requirements in precision work, the limits running as low as five ten-thousands of an inch. The works manager, Mr. U. Carpenter, had found that the method of introducing workers into factories and placing them on machines to learn their operation by the assistance of shop foremen and fellow-workers was not only costly but imperfect. The method adopted to overcome this common form of training was by having all the workers trained in a well-lighted room away from the factory, upon the kind of machines they were afterwards to operate in the large works. A few days', or sometimes weeks', training, by special teachers, qualified them to go into the works and operate machines without having any assistance from their fellow-operators, the foreman or leading hands in the factory.

Remarkable Advantages from Practical Training

Mr. Carpenter states that "in January, 1916, the average production of 31 women employees was eight pieces per hour." While operatives were apparently busy with this rate of production, my experiments showed that there should be produced from these machines, as a fair production, an average of 35 pieces per hour. We put our old operatives into the training department and within four weeks after the new and old operatives had been through this training department the average production was raised to over 35 pieces per hour, and to-day (January, 1918) the average is over 55 pieces per hour. The same results were obtained on all our work, such as machining, inspection, and assembling." These facts from actual experience confirm the opinions and recommendations of advocates of industrial training, and are sufficient to demonstrate the value of specific practical training. They also confirm the great possibilities of organized methods of labor, and show where work can be enjoyed while skill and output are increased.

Training and Examination of Adult Labor

The functions of the educational committee of production boards would include the classification of labor for such practical training and the direction of both men and women to the pursuit of higher grades of practical knowledge in the industry. Training courses, examinations, and certificates would be given, as in the case of juvenile workers.

3. Technical Training for Directors of Production

On first thought, the technical training for directors of production might appear unnecessary. Why should the director of production hold such a position in industry if not fully qualified, and, if fully qualified, why should educational training be necessary?

On reflection we are reminded of the technical facilities which are within the reach of directors of production who are helped by the technical press—patent office literature, proceedings from various institutions, reports of commissions and other organizations engaged in research and investigation for the solution of problems in industry.

Directors of production recognize that their education does not cease with their promotion to such positions, but rather the necessity of education increases. Much of that education which has to be secured outside the ordinary factory hours must be in tabloid or concentrated form. The real problem is to know how to place facilities for such education within their reach without overloading them with unnecessary information pertaining to other industries than their own.

Valuable Sources of Education Locked Up

In addition to the foregoing sources of information facilities are always available at the various universities and technical schools for evening study during the winter months. Lectures also are given at different institutions through which knowledge is imparted to directors of production, but it seems to me that the sources of concentrated technical education which ought to be of the greatest service to industry are locked up in volumes in different departments of the government—volumes the existence of which is not even known to the directors of production in industry.

There are, for instance, numerous volumes already issued by the Mines Branch, giving account of minerals, metals, fuels, and refractories, all of which are of vital importance to industry. In addition to these there are valuable reports issued by the Commission of Conservation, on questions of the utilization of Canada's resources, reports dealing with minerals, fuels, fisheries, game, animals, forests, lands, public health, waters, and water-powers, town planning, etc., information gathered by eminent men qualified to deal with the subject. There are also most valuable reports made by the

Department of Agriculture, the Department of Trade and Commerce, the Department of Labor, and other departments of government which would put industry under a deep obligation to the Dominion Government if they had the opportunity of utilizing the information contained in them. But, I ask, what is the value of all these records of industry? What percentage of men directing industry, such as manager, superintendents, chemists, and foremen, have ever heard of these valuable reports which minute investigation and much toil have made possible.

It has been my good fortune to have the opportunity of referring to many of these reports, and my regret has been that time would not allow of greater reference to them than was actually necessary in the prosecution of war work.

Central Authority for Classifying and Distributing Information

I cannot, however, believe that the task of wisely classifying for and distributing the results of those investigations to industry, through production boards or any other medium organized for this purpose, would be insuperable. I believe that special classification of information relating to problems and processes for each industry, together with the distribution of such information, could be undertaken by a central authority capable of dealing with the technical problems of industry as a whole. Such a central authority would not only become the principal body through which such knowledge would be imparted, but directors of industry would involuntarily turn to such an agency for assistance when in trouble.

Co-operation and Co-ordination of Sources of Information

If I were to venture to suggest for consideration a plan whereby the most efficient service could be rendered to industry through its directors of industry I would propose a union of the educational committees of production boards of each industry with the Industrial Research Advisory Council of the Government, or some similar institution which would have the authority to advise as to the use of all the technical educational sources of the country for the development of industrial research.

The value of such a union would be in the assurance of industry, through its production boards, receiving technical help and advice from the Industrial Research Advisory Council. With such co-operation and the co-ordination of the valuable technical departments of the government, universities, technical schools, and other institutions for industrial research, one can hardly estimate the value of such help to industry. Such co-ordination, in my opinion, is possible without any one of the institutions losing its identity or control. It might be necessary to re-arrange and classify the work of some of the institutions in certain respects, but such re-arrangement could be made after mature consideration.

Advantages Arising from Co-operation

Some of the advantages resulting from such a central authority as the Advisory Research Council would be as follows:

1. The classification of all information coming from the technical press, proceedings of institutions, reports of commissions, etc., suitable for the use of each industry, and distributing such information to the production boards concerned in each district. Such information could be supplemented with any observations and advice which in the opinion of the committees appointed by the Research Council would be of technical value to the industry concerned.

2. In addition to this source of information periodic conferences with directors of production in each industry could be arranged whereby discussions upon special processes or inventions could be held, with a view to the improvement of methods which would accelerate production.

3. Further, all information relating to standards of measurement, specifications for material, and standardization of processes would be supplied through the Industrial Research Council—in fact, the co-relation of the various departments with the valuable facilities for research in them could form the basis of an institution such as the Bureau of Standards at Washington and the National Research Laboratory, London, England, having committees for investigation and research in all technical matters relating to each industry.

In addition to this affiliation the production boards of each industry might be linked with the universities or technical schools of the district, so that in co-operation with the educational authorities facilities could be provided for the training of directors of production. To be afforded the privilege of using the various laboratories of the universities, colleges, and technical schools for experimental work which could not be carried out in the works of the individual manufacturer would be of great service to industry.

While I have referred particularly to Canada and her educational institutions which could be linked with organized industry, the same suggestions apply to the institutions and industries of Britain and other foreign countries.

Constitution of Central Authority

With regard to the constitution of such a central council for research the present body might wisely be enlarged to include the heads of such departments of the government now conducting research in different lines of industry. It might also be advisable to make the head of each technical department chairman of the section of the council's work relating to the operation of the government department over which he presides.

I believe the constituted machinery of the government, which has done admirable service in the past, with an efficiency which has been seldom recognized or fully appreciated, only remains to be geared up to some such central authority to make each department of the fullest value to the nation through the nation's industry.

4. The Education of Distributors of Production

We have, in conclusion, to consider the education of a class of workers who cover perhaps a wider field of operations as distributors of production than even the directors of production. They are not only concerned in recording statistics, accounting, and costing in relation to production, but in the distribution of products, involving shipping, railroading, and other means of distributing products—subjects in themselves which form a most important part of the problems of factory administration.

The work of the educational committee of a production board would include in a general way the consideration of the best systems of commercial training suitable for all branches of a factory's office staff, but there are, in addition, larger questions, which involve finance, accounts, costs, commercial law, the systematic study and familiar knowledge of which are essential if industry is to be established on an enduring foundation.

By linking the educational committees with the educational authorities whose institutions make a special study of this phase of educational work, plans could be more readily formulated for the education of distributors of production in every kind of development in commercial industry.

The Appointment of Advisory Council on Finance and Commerce

It might be found advisable to appoint a government industrial central financial and commercial advisory body of a nature and standing similar to that of the Industrial Research Council, but having for its object the classification of all matters of finance and commerce common or particular to each industry, and the distribution of such information as would

admit of the standardization of methods for educational development in factory administration, accounting, costing, commercial law, transportation, and all other matters relating to the interchange of production between buyers and sellers.

Such a council might consist of representatives of the leading financial institutions in the country, representatives of universities dealing with political economy and commercial training, representatives selected from the administrative side of large business houses, representatives from the institutions of accounting, representatives from the shipping and railroading companies, and representatives of the various government departments, such as customs, trade and commerce, finance, labor, etc. The objects, formation, and value of such a council to industry are worthy of the most careful consideration.

Gentlemen, I believe you are all ready and able to take your part in the education of the industrial worker, and I hope your society may give consideration to the proposals I have made.

Electrification of Canada's Railways

By John Murphy*

Note.—The writer wishes to acknowledge his indebtedness and to publicly return his thanks to officials of the railways below mentioned and of the manufacturers of the apparatus referred to, as well as to the technical press from which much of the following material has been gleaned.

Still smarting from the sufferings of two successive winters' fuel shortages, caused by inadequate transportation facilities, we are foregathered to see what can and should be done to prevent, if possible, recurrences of such serious and trying experiences.

No argument is required, I think you will agree, to support the contention that eliminating the need for coal at a considerable distance from the mine is a greater measure of relief, and of truer conservation, than increasing mine production and thereby incidentally adding more load to the already overburdened railways. Reducing coal consumption automatically relieves or releases men and apparatus all along the route from the mine to the consumer—it also relieves the route itself from some of its congestion.

So eminent an authority as Mr. E. W. Rice, the President of the American Institute of Electrical Engineers, addressing that body in New York last month made the following statement:—

"It is really terrifying to realize that 25 per cent. of the total amount of coal which we are digging from the earth is burned to operate our steam railroads—and burned under such inefficient conditions that an average of at least six pounds of coal is required per horse-power-hour of work performed. The same amount of coal burned in a modern central power station would produce an equivalent of three times that amount of power in the motors of an electric locomotive, even including all the losses of generation and transmission from the power station to the locomotive."

Mr. Rice went on to say that 150,000,000 tons of coal, nearly 25 per cent., as he said, of all the coal mined in the United States, were consumed in steam locomotives last year.

Here in Canada steam locomotives also did their bit, and consumed about 9,000,000 tons—30 per cent. of the 30,000,000 tons of coal imported into and mined in this country. Our 9,000,000 tons cover, I believe, wood and oil consumed on steam locomotives; some 49,000,000 gallons of oil are covered by the Canadian record. But in the United States' figures 40,000,000 barrels of oil, 15 per cent. of the total output, are not included.

The conservation of—the elimination of the necessity for mining—those great quantities of fuel would be secured if all the railways were operated electrically, and if the electrical energy were generated from water power. Modern steam central stations would save from 50 to 66 per cent. of the coal now used in steam locomotives if the latter were discarded and electric locomotives used instead.

With such possibilities for fuel conservation in sight may we not soon expect to learn that the fuel controllers in both countries have asked the railways, and that the railway managers have asked their engineers:—"How many of these millions of tons of coal can you save—when will the good work begin?"

It is said our fuel shortages were due to a combination of bad weather and inadequate transportation. As we cannot control the weather our attention and efforts must be directed to the transportation portion of the difficulty. Railway electrification will reduce coal consumption and haulage; it will also greatly improve traffic conditions; electrification, therefore, seems to be the solution of the problem. Under these circumstances it may not be out of place to recite in general terms what electrification has actually accomplished on some notable railways.

Railroading in the mountains is the most strenuous kind of railway work. The examples which I have chosen cover mountain sections. The Butte, Anaconda & Pacific Railroad, by electrification, increased its ton-mileage 35 per cent., and at the same time decreased the number of trains, and their incidental expenses, 25 per cent. The time per trip was decreased 27 per cent. It is said their savings in the first year's operation, after electrification, amounted to 20 per cent. of the total cost of electrification. They buy power from water power plants.

On the Norfolk & Western Railway power is obtained from their own steam station. Twelve electric locomotives have replaced 33 Mallets of the most modern and powerful type. The tonnage has been increased 50 per cent. Electrification obviated the necessity for double-tracking. The salvage value of the released steam engines was 45 per cent. of the cost of electrification. Electric locomotives make eight times as many miles-per-train-minute-delay as the steam engines. Their terminal lay-overs average 45 minutes, and they are double-crewed every 24 hours. Pusher engine crews have been reduced from 8 steam to 4 electric. Pusher engines or locomotives have been reduced from 7 steam to 2 electric. Steam locomotives used to "fall down" in cold weather—the electrics always "stand up," are really more efficient, in cold weather. At the New York Railroad Club meeting last year their electrical engineer stated that "coal wharves, spark pits, water tanks and pumps as well as roundhouses and turntables have all disappeared from the electric zone. Our track capacity has been doubled. Our operating costs have been reduced. From an engineering, an operating and a financial viewpoint our electrification has been a success."

Speaking of the value of the regenerative electric braking of their system he went on to say:—"The use of the air brake is practically eliminated, it is only used to stop trains; it is regrettable we are unable to put a dollars and cents value on this great asset; to appreciate it properly one must have had experience with the difficulties of handling 90 car trains with air." Another official, referring to the same subject, made the following statement:—"Trains of 103 cars are taken over the summit, 12 to 20 times every day, down the 2.4 per cent. grade without ever touching the air. We

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never broke a train in two or slid a wheel. It is done so easily we wouldn't spill a drop of water out of a glass in the caboose."

The 440 route miles of the Chicago, Milwaukee & St. Paul Railway which have been electrified will soon be augmented by 450 miles more. Nearly 900 route miles and about 33 per cent. in addition for passing tracks, yards, industrial tracks and sidings will soon represent the extent of this great railway electrification. Among the advantages secured by this railway on its electric sections are the following:—The cruising radius of each electric locomotive is twice that of the steam engine. Sub-divisional points, where freight crews and steam locomotives were formerly changed, have been abolished; the passenger crews' runs are now 220 miles instead of 110. For railway purposes these stations do not now exist; 7 or 8 miles of track have been taken up; through freights do not leave the main line track at all; shops and roundhouses have disappeared along with their staffs, and one electrician replaces the whole old force. An electric locomotive has made 9,052 miles in one month. Although schedules have been reduced the electrics have made up more than 2½ times as many minutes as steam engines—time which had been lost on other divisions; 29 per cent. of electric passenger trains made up time in this manner. On a mileage basis alone the operating costs of the electrics are less than one-half the steam engine costs. Freight traffic increased 40 per cent. shortly after electrification—double-tracking would have been necessary to handle such increased business under steam operation. An average increase of 22 per cent. in freight tonnage per train has taken place. One electric handles about 3½ times as many ton-miles as a steam engine; the reduction in time in handling a ton-mile is 30 per cent.; faster and heavier trains have accomplished these results, the number of trains has not been increased. About 11½ per cent. of the energy used by the railway is returned to the line in the process of regenerative braking, and this returned energy helps to haul other trains. While this is a very important item and reduces the power bills, it is only regarded by the management as of secondary importance in comparison with the more safe and easy operation of trains on the grades and the elimination of former delays for changing brake shoes and repairs to brake rigging when operating with steam locomotives. The electrics maintain their schedules much better than steam engines. In three months the electrics only waited for the right of way 254 minutes, while the steam engines in a similar period waited 1,910 minutes or 7½ times as long. Extra cars on trains only delayed electrics 1/9 of the time steam trains were delayed for a similar reason. Cold weather delayed steam trains 445 minutes in the three months under discussion, but the electrics were not delayed a minute; the latter are more efficient in cold weather. Many of the delayed steam trains were double-headers—never more than one electric is hitched to a passenger train. An entire suspension of freight service, due to steam engines losing their steaming capacity and freezing up was not an uncommon experience. Electrical energy for the operation of these trains costs considerably less than coal. This latter statement is one of the most interesting in connection with the operation of the C. M. & St. P. Ry. and it is especially interesting because it was made more than one year ago.

The limitations of the steam locomotive are due to the fact that it is a mobile steam power plant of very limited capacity; it is compelled to carry its own supply of coal and water, and it is unable to take advantage of many of the economical refinements of the large modern stationary steam plant. On the other hand, the electric locomotive has no such limitations; it merely acts as a connecting link between efficient gigantic stationary steam or water power plants and the train to which it is connected. The Electrical World summed up the situation a short time ago when it said:—"Why continue to haul millions of tons of coal, for and by uneconomical steam locomotives, all over the country, and thus add more loads to the already over-burdened railways, when the power which they need so badly can be much more economically and efficiently transmitted to electric locomotives over a wire the size of one's little finger?"

The continual increasing cost of coal and fuel oil will force railway managers to look more and more carefully into railway electrification. Estimates of a few years ago now need revision. Money may be hard to get, but, if at times fuel cannot be obtained at all, some substitute must be obtained if normal life is to be continued in northern latitudes.

A representative of the National City Bank of New York, writing of the period after the war, referred to the stagnation which may ensue in all the great industries now engaged in war work as soon as peace is declared; the multitude of people thus thrown out of work, in addition to the men of the returning armies, would create unbearable conditions unless suitable employment will have been arranged for them in advance; he referred to the economic advantages of railway electrification and was of opinion that this work might solve the whole question if soon taken up with vigor. The Minister of Public Works, Hon. F. B. Carvell, M.P., addressing the Ottawa branch of our organization a couple of weeks ago, spoke of the necessity of conserving the energy of our water powers—instead of letting them run to waste—so that this great store of energy might be employed in assisting to build up our own and to rebuild other countries when peace comes. How nicely these two ideas, water power development and railway electrification, work together if properly carried out?

With the view of securing something really worthy of presentation to this important meeting I recently wrote an eminent engineer, a man of international fame, and recognized as an authority on railway electrification, requesting him to tell me his own views upon this subject. A specialist's opinion, in my opinion, is always very valuable. Here is a short extract from his interesting reply. He said:—"Generalization is always dangerous, especially in connection with electrification of railways, where so many factors, such as the physical location, character of loads, the power situation, etc., come in to affect the decision if applied locally." From his sober statement it may be seen that my correspondent is an engineer—not a politician. He proceeded as follows:—". . . . with present equipment prices the cost is absolutely prohibitive." This opinion, let me point out, is in connection with the proposal to "electrify everything." Do not let it dampen our enthusiasm. Listen to this also and kindly keep it in mind; it is another extract from the address of Mr. E. V. Rice, above referred to. He said:—"I think we can demonstrate that there is no other way known to us by which the railroad problem facing the country can as quickly and as cheaply be solved as by electrification."

While the present fuel shortage questions have made us look to railway electrification for relief I feel such a project on a large scale can only follow or go hand in hand with power plant development and co-operative operation of power plants. The location of a number of plants at different points—large water power plants and auxiliary steam plants—so situated and inter-connected that a failure at one plant or the connections to it will not jeopardize the others or completely cut off and isolate an important railway district is, in my opinion, an essential feature in connection with any large railway electrification project.

The 99-year contract of the C. M. & St. P. Ry. is worthy

of more than a moment's attention and consideration in this discussion. That railway has a contract with a power company which has a series of plants stretching across the country parallel to the railway. The railway owns its substations and secondary lines but is not concerned with the high tension lines of power plants of the power company. A reasonable rate for power arranged between a willing purchaser and a willing seller—a contract in fact which each party knows the other will respect—is the basis and the real reason for that great railway electrification. Neither party questions the other's integrity or financial soundness. One delivers the power it has undertaken to supply and the other uses it. The arrangement is ideal in its simplicity and entirely satisfactory to everybody concerned. It will, in my opinion, be necessary to have such attractive power-supply situations as those outlined above, backed by abundant supplies of power, in order to foster and encourage early railway electrification work in this country.

Central Heating as Means of Conserving Fuel

By F. G. Clark*

Central heating is the replacement of two or more individual heating systems by one source of heat. The electric central station and the gas generating plant are illustrations of central heating to the extent that their respective forms of energy are used in connection with heating appliances. The use of electric energy and gas for this purpose is being dealt with in other papers which probably means that the writer is expected to deal only with steam heat distributed from a central generating plant. As the subject probably covers steam for power, providing it comes from a central plant, this enlargement will be made. We therefore have as our subject central steam plants as a means of conserving fuel by replacing isolated power and heating plants.

The relative merit of high versus low pressure systems has been the subject of much discussion. It appears that the high pressure systems were originally installed before electric energy became an important competitor of the steam engine. The central steam plant was generally able to substitute its service for the boilers of the consumer, and although the steam engine is no longer an important factor, the high pressure system remains in a number of large cities, and probably for the reason that the generating plants have high pressure boilers, and the street main cost of low pressure piping is high in comparison. The ideal system would take low pressure steam from a steam electric power plant. The steam would be taken from the low pressure stage of steam turbines through suitable regulating valves, and be superheated by a suitable heat exchanger before passing into the street mains.

The conditions which best suit this method of supplying heat, are a closely built up section of a city and a central location for the supply plant. The location of the station and the congested area usually gives a fan-like distribution system. As an economic proposition the central heating plant can offer to customers in a limited district a supply of heat for approximately what their coal would cost them, leaving a fair return on the central heating system investment. The purchaser of steam avoids the necessity of purchasing and operating boilers, saves the space they and the fuel would occupy and is free from the troubles of operation. Steam mains laid in city streets, while not entirely free from troubles, usually give ample warning of failure, and can be depended upon for continuous service.

The loss of heat is a more or less constant quantity, depending upon the length and size of pipe, its insulation, the difference in temperature of steam in the pipe and the surrounding earth, and the leaks. The nearer to capacity the mains are worked the smaller is the percentage of loss. A well-designed system, as for example, one covering that part of Toronto between the bay and College Street, and from Sherbourne Street to Spadina Avenue, if supplied from a central plant such as the Scott Street Station of the Toronto Electric Light Company, would be able to furnish all of the heat required in the district at a cost to the users from 10 to 30 per cent. less than their present expense. The saving in coal might be over 30 per cent., but in any case the cost of coal at the central plant would be sufficiently less than its cost delivered throughout the district to offset the fixed charges and heat losses of transmission through the streets.

On the assumption that 75 tons of anthracite at $9.00 a ton, and 150 tons of bituminous at $7.00 per ton is used in the district each week day for six months, and proportionately smaller quantities during the remainder of the year, the cost of steam under present conditions would be over $500,000 per year, of which the coal cost is about $400,000.

The central heating company would be willing to supply an equivalent quantity of heat for the cost of the coal, depending upon their own saving in coal and its cost to meet expenses and pay a dividend.

The conditions throughout Ontario and the populated parts of Quebec are ideal for the development of central heating plants because of cheap electric power, the number of heating days and the high price of coal. Every town of 10,000 or more inhabitants and with buildings not too widely scattered affords an opportunity for saving coal if it will support a well designed and well operated central heating plant. The smaller towns should depend upon hot water circulation, the water being heated during the hours when electric energy could be taken from steam engine units used to produce the exhaust steam needed for heating. The Hydro municipalities could use some of the energy they have been expending upon the radial railway scheme in the solution of this problem, and produce an economic saving of value to themselves and the country.

I would not care to make an estimate as to the saving that would result from a comprehensive establishment of central heating plants throughout the country. It is altogether improbable that any installations will be made in the immediate future. The idea of cheap hydro-electric power unlimited in quantity and in its capacity to replace coal has so taken hold of the people of Canada and of Ontario in particular, that they are simply waiting for the end of the war or the completion of the Chippewa development to heat their buildings electrically and thus entirely do away with coal. I will, however, venture one prediction which will have a considerable bearing on the question of central heating, or rather on heating in general. It is, that within ten years, gas and coal briquettes will replace the anthracite and bituminous coal now used and that the gas and the briquettes will be made from powdered coal sent from the mines to Hamilton or Toronto or London in pipes, just as oil is now pumped from Oklahama to the Atlantic Seaboard. The cost of the gas and the briquettes will be less than one-half and possibly one-fourth the present prices for gas and coal. What the situation with respect to the central heating will then be is left to your imagination.

*Chief Engineer, Toronto Power Company.

Transmission Line Practice—Construction and Costs—Article V.

By Lieut. E. T. Driver and E. V. Pannell

The chief problems of engineering at the present day are economic ones, and the achievements of the science are worthy of note only where a true economic problem has been solved. For instance, the development of a water-power some three or four hundred miles up-country, its transmission across unpeopled terrain, and delivery at a centre of commerce, whilst effecting a technical result, cannot be classed as an engineering achievement unless the same energy will turn the wheels of industry for a lower cost than any other means and still pay interest on the capital outlay involved. Power stations have been very highly developed along economic lines, substations still more so, and the main reason why energy which can be transmitted 200 miles cannot equally well be carried 500 is simply that the transmission line costs too much.

A careful study of the different factors of cost in transmission line work is, therefore, important, and the time when every motor will be turned, every lamp lighted, and every train operated by hydro-electric energy will arrive only when the cost of transmission lines, their construction and operation have been reduced to the minimum.

Briefly summarized, the main factors in the cost of transmission line are as follows:

1. Right of way—(a) Easements or purchase; (b) clearing.
2. Surveys and engineering.
3. Material—(a) Tower steel; (b) conductors and ground wire; (c) insulators; (d) hardware and equipment.
4. Labor—(a) Distributing material; (b) digging holes; (c) setting footings; (d) assembling; (e) erecting; (d) setting insulators; (e) stringing wire and cleaning up.
5. Interest.
6. Contingencies.

The right of way item is necessarily the most uncertain of all the cost factors; in some cases it has been the practice to

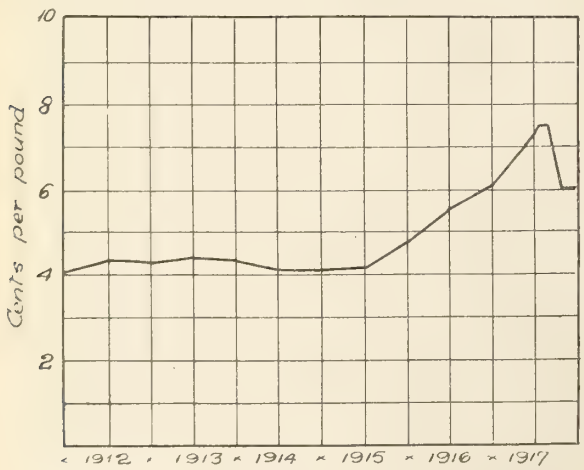


Fig. 16—Prices of galvanized steel shapes for towers during years 1912 to 1917

expropriate a strip of terrain from 50 to 100 feet in width for the whole length of the line. In the case of one very large transmission system in the South, an average of $11.42 per acre was paid for a 100 foot wide right of way for easements covering the right to erect towers and to patrol and maintain the line. This cost works out at about $15 per tower. In another similar system the cost of similar easements amounted to $1,200 per mile, which figure is also stated to cover the cost of surveys and engineering. Allowing the fairly representative figure of $500 per mile for these items, the actual cost of right of way and clearing amounts to the appreciable figure of about $700 per mile, or nearly $80 per tower. Between the above two examples most costs of right of way will be found to lie. Necessarily with the growing appreciation of the vital importance of cheap electric power it will become the regular practice for legislative assemblies to grant an act of eminent domain to all bona fide power transmission systems and to set a maximum price on land particularly where it is being held for the exploitation of the power company. The item for clearing will generally be inversely as that for easements, be-

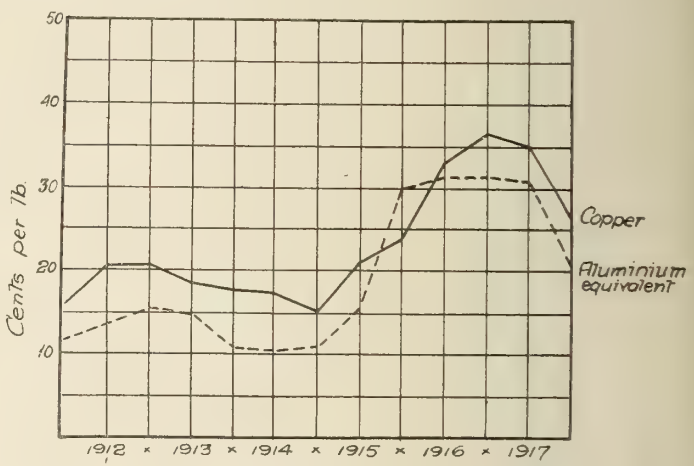


Fig. 17—Prices of copper transmission cable during the years 1912 to 1917

cause the most costly right of way will be that across cleared and cultivated country.

Surveys of the kind necessarily for power transmission lines are frequently effected at a cost of $100 per mile or less, whilst subsequent engineering expenses account for about $400 per mile. Naturally much depends upon the extent of the system, its accessibility and the type of country. It will in most cases be found that these figures are upon the high side As in every other kind of field work, a careful and perhaps costly survey may save several hundred dollars per mile on subsequent operations.

Turning now to the item for material, the most important is perhaps tower steel. The market prices of small galvanized steel shapes of the kind used for transmission towers, cut and punched in 500-ton lots, have varied somewhat according to the curves in Fig. 16. A great diversity of shapes in the required tonnage would, of course, involve still higher prices than these, together with more protracted deliveries. The difficulties in respect of steel, together with copper and aluminium, have been not only the prices, but the scarcity, of metal, and the congested state of the mills. Figures 17 and 18 show the price tendencies in copper and aluminium conductor cables during the last six years, and provide sufficient evidence that an increase in power rates is necessary if hydro-electric energy is still to be generated and transmitted.

In the early days of the war it was customary to speak of the time when prices would return to "normal" levels. This unsound economic argument has since been exploded, not, however, before scores of important engineering projects had been postponed awaiting the return to "normal" prices. Briefly, the cheapening of the gold standard has appreciated

every raw commodity by 100, and the condition will probably obtain, with minor market fluctuations, for the next half century.

Similar comments apply to the situation as regards labor and construction costs, with the qualification that in this case economies of considerable magnitude can be effected by careful organization. It is a matter of experience that the construction costs for the extensions to a transmission system are ceteris paribus lower than those for the initial undertaking, and, with the collection of actual working data, the unforeseen elements can be reduced to a minimum and costs also diminished. The seven items of cost in the "labor" category for six different transmission lines aggregated as follows:

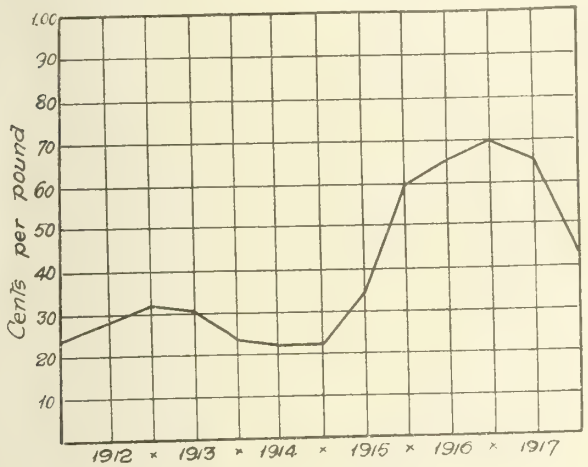


Fig. 18—Prices of aluminium transmission cable during the years 1912 to 1917

	Per tower.
System No. 1	$30.00
System No. 2	42.25
System No. 3	79.39
System No. 4	54.81
System No. 5	59.24
System No. 6	67.60
Average	$55.55

System No. 3 was over very unfavorable country, with considerable guying for angles. It would be found at the present time, however, that this figure is not far short of being representative, and that $80 per tower is not an unreasonable estimate for the construction costs associated with wire are included in this. The actual tower construction costs a 4,000-pound structure. Hanging insulators and stringing are estimated as follows:

Cost of tower steel, galvanized, punched, and bundled, per pound		7.000 cents
Cost of distribution	.20 cents	
Cost of digging holes	.35	
Cost of setting footings	.25	
Cost of assembling	.40	
Cost of erecting	.30	
		1.500
Total cost of tower erected, per pound		8½ cents

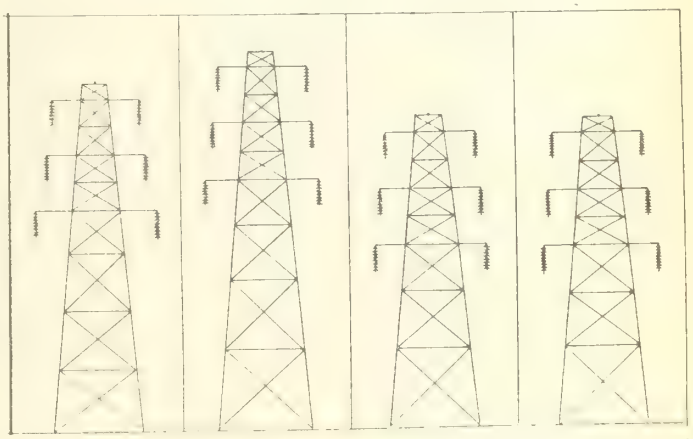
These items, it will be seen, are all dependent upon the quantity of material to be handled, and are, therefore, best expressed as a function of the net weight of the tower steel involved in the line. Setting insulators and stringing cables and ground wires are expressed by a fairly constant figure per tower:

Hanging insulators, per tower	$ 6.00
Stringing wire and cleaning up, per tower	15.00

All the above figures have been arrived at by a study of a large number of 100,000-volt installations using double circuit three cross-arm towers, spaced about 8 to 10 per mile. No intention is implied, however, to do more than merely outline the method of estimating, because the adoption of published figures for serious work would be disastrous.

For the purposes of this article interest during construction is assumed at 5 per cent. of the total cost of material and and labor, and contingencies may be considered fully taken care of by an equal allowance. Necessarily the first item will depend upon the time occupied between the placing of the first contracts for material and the first supply of power over the line. It will be lower where the line is short and where construction work can go ahead all the year round. The contingencies item amounts to a safety factor to cover work not anticipated under the heading of surveys or engineering.

It will be interesting to investigate the estimated costs of material for a twin-circuit transmission line carrying 50,000 kw. at 110,000 volts, 60 cycles, and to consider particularly the alternative use of different conductor materials. The size of cable will be 4/0 B&S copper, and the equivalent size in aluminium, aluminium-steel, and copper-clad steel. In Fig. 19 have been worked out the towers for these four cables on a 600-foot span. It will be seen that the total weight of steel per mile is not very different for copper or aluminium, but is appreciably more for aluminium-steel, and reaches a prohibitive quantity in the case of copper-clad steel. The reason is that these two latter conductors are not being economically employed at a span of 600 feet, and if these cables were all compared on the basis of 1,000-foot spans the higher tensile conductors would show up more favorably. However, in view of the fact that copper-clad calls for nearly the same height of tower as aluminium-steel, whilst the tension along the line is twice as great, the towers for copper-clad will always cost about double those for aluminium steel. If there were any saving on the conductor material itself to balance



Conductors.	Copper.	Aluminium.	Aluminium-steel.	Copper-clad steel.
Size, equivalent	4/0	4/0	4/0	4/0
Maximum sag, feet	14.4	20.4	8.2	7.6
Tower height, feet	62.4	68.4	56.2	55.6
Horizontal load, pounds	15,000	10,500	26,600	48,600
Weight, standard tower	4,700	4,150	6,700	12,300
Weight, special	7,050	6,210	10,000	18,400
Span, feet	600	600	600	600
Total steel per mile	49,400	43,600	70,400	129,500
Unit price erected, cents	8½	8½	8½	8½
Total cost per mile, dollars	4,200	3,700	5,980	11,000

Fig. 19—Towers for a 600-foot span with different conductors

this inequality there might still be a good case for copper-clad for regular transmission work across country, but, unfortunately, the cost of this type of cable is higher than any other. It must, therefore, be considered economically unsuited for the purpose, except in the case of special river crossing spans or any locations where the conductance is of little or no importance so that a relatively small conductor can be selected.

The average span of transmission systems ten years ago was in the vicinity of 400 feet. This value has gradually extended until the majority of long-distance systems are now

being constructed, with spans of 750 to 800 feet, in favorable country. This tendency is dictating the use of materials of higher tensile strength, such as aluminium-steel, which, with the relatively small sag, call for a short tower. The tower will, of course, be heavier for its height than a structure for copper or aluminium cables, but with long spans it will be found that the net weight of steel will be less.

Turning from materials to methods of construction it should be mentioned that the above tower costs are based upon earth stubs. In other words each tower leg is bolted to a heavy angle member, extending some six or seven feet into the ground and terminating in a steel grillage. As a standard footing this arrangement is used with success on the majority of the high tension lines now in operation. Where bad ground is encountered, however, the concrete footing is necessary, and the same applies to crossing towers, and where any doubts exist as to the nature of the ground, to angle and dead-end towers also. In a few instances a complete tower line has been set with concrete footings, but this extra cost (usually of the order of $100 per tower) is very seldom necessary if the possibilities of a well-designed earth stub are carefully considered.

Stringing wire is a rapid process in good country where a team can be employed, but is more troublesome with only manual labor. It is customary to provide the foreman of the stringing gang with a table of sags, and these are sometimes worked to, to the exclusion of the dynamometer. Now, although it is important to string with the correct sag, the dynamometer should not be neglected, because it affords an opportunity to take the flexibility out of the cable by pulling right up to the elastic limit and then letting it gradually down to the required tension. It is certain that if this practice were regularly followed out there would be less need for re-stringing lines.

Canadian Railways Using Women Conductors

As the difficulty increases of keeping male employees as electric railway conductors, Canadian roads will doubtless find it necessary to substitute women for this work. In certain localities conditions, of course, are not favorable, but in others the experiment has proved very successful. One example is that of the Nova Scotia Tramways and Power Company, who are employing something over 20 women conductors at the present time. Regarding their efficiency, Mr. H. R. Mallison, managing director of the company, writes as follows:

"We have approximately 22 women working as conductors, and their services are what might be termed reasonably satisfactory. We have had them employed in this capacity long enough to be able to judge as to their ability, and we firmly believe that if the women are desirous of doing the work, and will take the proper interest therein there is no doubt that they can discharge the duties fully as efficiently as the average man. Amongst the women employed by this company there are six or seven whom we consider as efficient in every respect as any of the men we employ.

"I am under the impression that at the outset a number of the women who took up the work did so without realizing the difficulties of the position, and during the severe winter weather they were physically unfit to stand the strain; others took up the work more in the nature of a lark, and were careless and negligent in the performance of their duties, indulging in a great deal of skylarking with passengers on the cars, and, as a result, were dismissed within a short time. Difficulty was also experienced in impressing upon a number of the women the absolute necessity of being on time to take over the cars and of advising the car starters of their inability to return for duty. With those who remain in the employ at the present time the majorty of these difficulties have been overcome, and, as I before stated, we find some of them are equally as efficient and reliable as the men, and with others the main difficulty is their physical inability to handle the work. I believe that, with the improved weather conditions, the difficulty in this direction will be very considerably removed, and that we shall have as much satisfaction from the employment of women conductors as we have from the employment of men."

B. C. E. R. Co. After Domestic Business

In our last issue we described the plan of campaign of the city of Winnipeg electrical department to place more household equipment. The British Columbia Electric Railway Co. also started their campaign for the sale of electrical appliances early this spring. In the week commencing January 15 they put on an electric washing machine campaign, and gave daily demonstrations at their main salesroom; also one of the electrical dealers demonstrated the machines in his windows. The company's four outside selling agents followed up the prospects obtained at the demonstrations and also made house-to-house canvass in the better class districts, with the result that they sold six machines during the week and fourteen more since then—nearly $3,000 worth of business in washing machines already this year. They have also this year featured suction cleaners and electric ranges in their advertising and solicitation, with very good results. Outside agents are paid on a salary plus commission basis.

We print below copy of a letter which was mailed two or three days before the agent's call during the summer months last year, and which resulted in excellent business in grill-stoves in districts where gas for cooking was not available. The agents found that they were given a chance to demonstrate the appliance in nearly every case, and state that the results of a house-to-house canvass can be greatly increased by such a letter at very little additional cost. The campaign was under the supervision of Mr. Edmund E. Walker, sales engineer.

Letter Preceding Agent's Call

Dear Madam:

Within the next 3 Days our representative will be in your neighborhood demonstrating in the homes of our consumers a most useful household appliance known as the Electric Grill-stove.

Your name is included on his list, and we hope you will make it convenient to grant him a few minutes of your time.

He will explain the indispensable uses to which this electric table stove can be put. You will be surprised when you see how easy it is to execute small cooking operations. How, in fact, the whole of your cooking can be done quickly and in an entertaining manner should guests call to see you.

He will also tell you about our easy payment plan, whereby you can own one of these appliances with a very small immediate cash outlay.

We feel sure you will find the demonstration an interesting one, and take this opportunity of thanking you in anticipation for granting a short interview.

Your truly,

Edmund E. Walker,
Sales Engineer.

Canadian Electrical Association Meeting

The Managing Committee of the Canadian Electrical Association have decided that their annual meeting this year shall take the form of a one-day strictly-business session, to be held some time during the latter half of June. It has not been settled whether the meeting will be held in Quebec, Ottawa, or Toronto, but this will be determined within the next few days by a letter vote of the members of the association.

Teach Children to Respect Dangling Wires

Winnipeg, Man., April 19, 1918.

Editor Electrical News:

I have read with much interest your comments on your correspondent's suggestion as to advisability of teaching children in the public schools the necessity of refraining from touching any wires dangling in the streets. I have passed this along to Dr. McIntyre, superintendent of the Winnipeg Public Schools Board, urging him to endeavor to carry this out. We have in the past had regrettable instances of the danger of touching broken wires in this city. In some cases these have resulted in fatalities, and the wonder is that a larger number of fatal accidents have not taken place, as I know personally of quite a few instances where 2,200-volt wires have been burnt off and have been found hanging in the streets, and constables and other officials of the city have attempted to handle these, with the very best intentions, no doubt, but with miraculous escape from receiving serious shocks. I trust that your suggestion will meet with general approval, and that it will be carried out in a practical manner. I am,

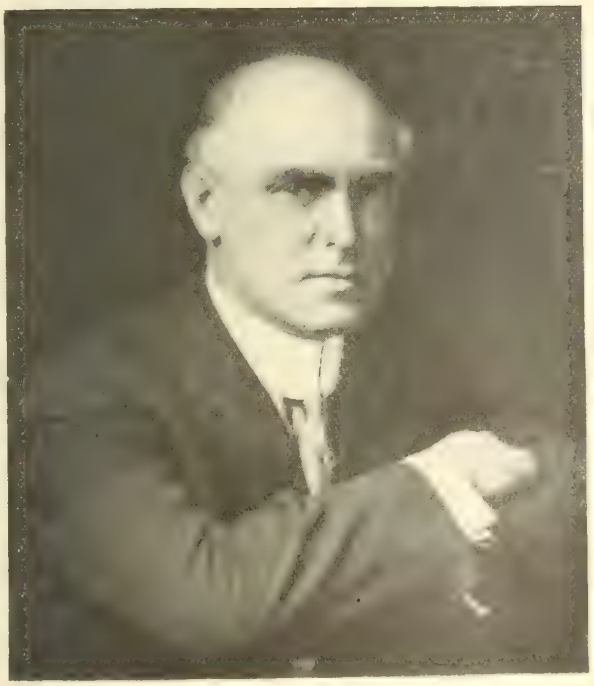
Yours truly,

F. A. Cambridge,

City Electrician.

Packard Electric Changes

A change in the management of the Packard Electric Company, Ltd., St. Catharines, Ont., has taken place during the past month. Mr. George C. Rough, who has been secretary and sales manager of the company for a number of years, has been elected president, and their chief engineer, Mr.



Mr. George C. Rough

Frank T. Wyman, vice-president, both to act as joint managers of the company.

Mr. R. B. Hamilton, who has been president and managing director, has been relieved of his duties in order that he may devote his entire time and attention to war contracts in connection with the Packard Fuse Company, Ltd.

Plans are in progress for a new distributing station for the city of Sherbrooke, Que.

The Montreal Tramways Commission

Prof. L. A. Herdt, of McGill University, electrical engineer; Mr. John S. Archibald, architect, and Judge St. Cyr, of the Court of Sessions, have been appointed members of the Montreal Tramways Commission. Prof. Herdt was the consulting expert of the original commission which enquired into the conditions which resulted in a new agreement for a fresh franchise being concluded between the Tramways Company and the city, and he was also a member of the valuation committee of the commission which fixed the capital value of the company. He is a member of the electrical commission which has the charge of designing and constructing the civic conduits.

The new contract is for 35 years, and the commission has jurisdiction over all the company's lines or any of its subsidiaries, so far as finances, operation, extension, and disputes are concerned. The powers are very extensive, and cover the entire range of the company's working, financial as well as the operating end. One of the first subjects to be discussed will be that of fares, which can be modified by the commissioners.

The members of the commision are appointed for ten-year terms, but can be removed by the Lieutenant-Governor-in-Council for cause, and either the company or city of Montreal can demand the removal of any commissioner for fraud, corruption, and refusal to fulfill in good faith his duty, by means of quo warranto proceedings.

Promoting Better Relations with the Public

In its desire to promote good relations with the public and effect a clearer understanding of the utility problems, the Winnipeg Electric Railway Company has established a publicity department which will be under the direction of H. C. Howard, formerly on the staff of the Winnipeg Free Press. In connection with this publicity department it is the intention of the company to issue a publication which will take the form of a pamphlet, and distribute same, as regularly as they are published, through the medium of the street cars. This publication will provide a closer and more direct means of communication between the company and its patrons, and it is expected will be instrumental in improving relations between the company and the employees, helping them in the discharge of their difficult duties to the public. Matters of public interest will be discussed in the columns of the paper, and from the frank talks which will appear therein from time to time it is expected a greater degree of confidence and good-will between the company, its employees, and the public will be attained.

The Problem of Service

Mr. A. O. Dawson, vice-president and general manager of the Canadian Cottons Company, Ltd., was the speaker at the Montreal electrical luncheon on April 10. His talk, on "The Problem of Service," was a consideration of the duty of service to our fellow-men, involving sacrifice of life, time, and wealth. All progress, he remarked, was accompanied by the sacrifice of men. The only method by which men could get away from self-centered living was by sacrifice, and the only way by which they could develop their better selves was by serving others. The men who thus served their fellows must exercise patience, and must not be surprised if their efforts were not always appreciated. In commenting on the war, Mr. Dawson said that the time might come when Germany would recognize that the Allies were serving Germany by this conflict. There would never be peace in this world until the nations got together in the spirit of helping one another, and not with the idea of crushing nations. The spirit of service engendered a feeling of optimism and brought joy into the lives of those who served as well as those who benefited.

The Dealer and Contractor

A Letter from the "Field"—Mr. Rufus Earle with the Army in France Describes Some of His Experiences

Our Toronto electrical-contractor readers and many others throughout the province will be glad to know that Mr. Rufus Earle, one-time secretary of the Toronto Electrical Contractors' Association, has gone through two years of useful experience in Europe and is still hale and happy. Mr. Earle, it will be remembered, left Canada with Colonel S. S. Sharpe's regiment. Apparently he was having an hour or two off duty on March 10 last, and possibly was a little bit homesick, for on that date he wrote his brother Gordon a long and most interesting letter, which we are privileged to reproduce, in part, below. In one place he says: "Mail from home is eagerly looked forward to, and if you only realized how much the news about friends in Canada is appreciated and the news about what is going on, I am sure that everyone would write more frequently." Now, can't you, friend reader, spare him a half-hour of your pen and ink? The following are the extracts from his letter:

"In the Field, March 10, 1918.

"The last few days the weather has been glorious, and quite warm, but, of course, we must expect some bad weather yet. I was at the Vimy Ridge scrap on April 9, last year, and the weather for two or three days before and on the Easter Monday morning, when the attack was launched, and for a couple of days afterwards, was terrible—cold, with sleet, snow, and rain. The morning of the attack however, the gods were with us, and the heavy sleet storm was blowing right in Fritz's face. He had been expecting the attack every morning for about three weeks, and had been standing-to every morning; but on Easter Monday, when his lookouts saw the weather condition they must have decided that there would be no attack that day, and gone back to bed, because he was taken completely by surprise. All through March, and until about the 15th of April, 1917, the weather was very cold, but, following that, it was beautiful. The fall of the year is also beastly weather. I was at the scrap at Passchendaele Ridge, before Ypres, in Belgium, in October and November, 1917, and the rain was almost incessant, and the roads and paths almost impassable. "Duck-boards," or latticed sidewalks, had to be laid on the ground to facilitate the passage of the troops, the rations, and the ammunition up to the line. I have actually seen a mule track through the mud made of 9.2 in. howitzer shells (unexploded ammunition), laid on their sides, and forming a corduroy road, over which the pack animals walked. Lord knows what a shell of that size costs, but it is the biggest gun outside of the big long-range guns situated away back.

"My trip to Paris was the experience of a lifetime, and I only want to see more of this country before the opening of another new year. To take the fourteen days' leave, which is the period now, requires about 1,000 francs, and I have not nearly that much on my pay book. Prices have gone up tremendously over here. Rooms at hotels are remarkably cheap, and you can get really first-class accommodation for from 6 to 7 francs a night (roughly, 20c to a franc), but food is very expensive; also tobacco, etc. For leave in France you have to pay your own fare on the railways after you leave the zone of the armies, but the fare for soldiers is remarkably cheap. The military travel third-class, and the fare for a man in uniform, whether French or allied, is about 5 centimes a mile, or about ½ cent. Coming back from Paris to Amiens we slipped it over their eye, and bought first-class military tickets. I do not know what the distance is, but we rode first-class on a fast train from 11.40 p.m. to 4.44 a.m. for 3 francs 40 centimes each, or about 63c each. The rate for civilians, however, is not cheap.

"The Bosche bombing planes were over our vicinity last night and the night before, for the first time in about three weeks, but they did not come anywhere near us. There is no moon at the present time; the new moon doesn't start until the 12th. I suppose we will have him back as soon as the bright moonlight nights come again. I never mind him as long as I am in company or in bed. However, I have to work every night until about 9 o'clock, and when the moon rises early and I am alone in the office and busy when he comes over, it is not very pleasant. However, it is all in the game, and the chances of him hitting are very small. He came near enough one night about three weeks ago to let us see the upheaval caused by the explosion of the bombs in an adjacent field, and to hear the bombs swishing down through the darkness. However, when he gets that close they generally get the searchlights focussed on him and then start at him with the "Archies" (anti-aircraft guns) and the machine guns, which generally turn him away from us. The heavy 60-pound aerial bomb is a fearsome thing, and does tremendous damage. There have been casualties in camps on both sides of us, but up to the moment we have escaped scot-free. We have an aerodrome right alongside our camp, which attracts his attention. Yesterday one of the planes came in and made a safe landing, after having been riddled with machin-gun bullets through the body of the car, the propeller and the tail, and after the pilot had received three bad leg wounds. I hear that it was brought in by the observer. They had been attacked in the air by eight Bosche planes, and, after bringing one of the Bosche down, had to run for it, and escaped in comparative safety. It was a smart piece of work. Another chap came back yesterday. He was 40 miles away from the drome and 20,000 feet in the air when his engine gave out, and he was forced to plane for it, with his engine just running by fits and starts, and for some considerable intervals he was without the engine at all, and he got home, making a perfect landing. To-day, being a fine day, the air has been full of planes all day. I couldn't sleep in my tent this afternoon for the constant roar of their engines. The half of this war will never be told.

"I often think that I would like to be home again, recounting some of my experiences out here, and the things I have seen, but some are so horrible that they are best forgotten. Of course, there is always the humorous side, and a sense of humor is a saving grace out here. One of the

strong points on Vimy Ridge held by the Germans was La Folie Wood. You have no doubt read and will remember the names of the strong points held in that battle which cost so many Canadian lives—'La Folie Wood,' 'La Folie Farme,' 'Ecole Commune,' 'Bois de Chaudiere,' etc. 'Folie' Wood is contracted by the Canadian Tommy to 'Foley's Wood,' and a chap said in our battalion one day when we were going over the ridge to go in the line, which was at that time about three miles in advance of the ridge: 'I have one ambition in life, and that is to see old man Foley come back and try and run that farm.' When you remember that the craters made by our heavies are so close that the lips run into each other; that the whole area is covered with ruined cement machine-gun posts and barbed wire, twisted iron, and that tons of unexploded explosives lie beneath the surface of the ground in 'dud' shells, you will realize the humor of the saying. That is one of the mysteries out here. Where are all these people whose names are so familiarly used by us every day in speaking of farms, houses, etc.? Can you imagine them coming back to these scenes of desolation where once they lived and labored at peace, and to the homes where they were, possibly, born and educated? It is pathetic to see civilians come back to a ruined town after this is made possible by a British advance. It is also pathetic to see with what tenacity some cling on to their homes and little shops and estaminets, even under heavy shell fire, and will not leave. You see houses still unoccupied without a pane of glass, the window frames being filled with sand bags to protect the inmates against flying bits of shrapnel and shell casing—houses where every night the owners sleep in the cellar, and where they take refuge in the cellar every time the shelling starts, and still they refuse to move. I have seen farming going on under shell fire, the peasant—and sometimes it is a woman—calmly driving the plow, apparently oblivious to all else but the duties of getting in the crop.

"In a little village at which we were billeted near Lens some time last year, myself, our regimental quartermaster-sergeant, the company sergeant-major of 'D' Company, and one or two others, were sitting in the kitchen of an estaminet having a bottle of white wine, when a Bosche heavy shell whizzed up a nearby lane and exploded about four or five hundred yards back of us. The old man and the old woman immediately beat for the cellar, and the daughter followed them in the rear, bearing a lamp and the cash box, and left us all sitting there. The desolation in France that I have seen, however, is as nothing compared to the horror of Belgium. The destruction of Ypres is indescribable. By the way, while I was up in Belgium I saw the famous White Chateau, where the notorious Von Bissing used to live at one time. Belgium is well named the graveyard of the Canadians, and we left some of our best boys there, but the Canadians made history there, when others had failed. War, as it is played out here, is a very modern and up-to-date institution. Within fifty yards of where I sit is a cinema theatre, which will seat 500, and which runs two shows every night, Sundays included. This afternoon—Sunday—there was a boxing tournament held there. A few hundred yards more down the road is another theatre of about the same size, where a concert party of about 30 members is putting on shows nightly. The battalion has started work on their farm, and have every promise of lots of fresh vegetables this summer, if we are not rudely disturbed by the Hun, while some of the officers have had bulbs planted around their huts, between the outer wall of the hut and the 4-in. wall of sandbags which surrounds it, the intervening space being filled with earth, which forms the garden. Football matches are played by neighboring imperial troops on our front lawn almost daily. Do not imagine that the troops are badly fed. Our menu for to-day, which is a fair sample of what we get in mess regularly, was: Breakfast—Porridge, bacon and egg, toast, marmalade, and tea. Dinner—Roast beef, mashed potatoes, cauliflower, rice pudding, and tea. Supper—Boiled ham, mashed potatoes, pie, and tea. Such things as condensed milk, sugar, margarine, and butter, which are very scarce in England, are well supplied to the troops. Of course, this is the sergeants' mess, where a considerable amount is expended in extra rations each month, but the men fare well, also—much better than could be expected."

Toronto Electrical Contractors' Association—Don't Miss the May Meeting—Important Matters are Coming Up

The monthly meeting of the Toronto Electrical Contractors' Association, held in the Walker House on April 4, was one of the most successful of the year. President McIntyre, who has just returned from a meeting of the National Association executive in Detroit, announced that arrangements had been concluded with the National Association of Electrical Contractors and Dealers whereby the Toronto association could purchase certain of their data sheets for distribution among the members. Mr. W. C. Peet, chairman of the National Association, was very cordial in extending an offer of co-operation.

A letter was read from the secretary of the British Columbia Association of Electrical Contractors and Dealers with particular regard to the affiliation of Canadian associations with the new National Association. This question is being followed very closely by the officials of the Toronto Electrical Contractors' Association. Mr. McIntyre, just having returned from the National Executive Committee meeting at Detroit, spoke at some length on the Goodwin plan, reading the definition of the Goodwin plan, with comments, laying particular stress on the fact that the movement is now under way, and that it is being continued, principally through trade journals and trade organizations, and noting the various statements as to individual and organization responsibility in the industry. The Goodwin plan, which was fully outlined in the Electrical News of December 1 and December 15, 1917, is, briefly, as follows:

THE GOODWIN PLAN

A campaign of education, conducted principally through trade papers, trade organizations, and other channels, to co-ordinate the various interests in the electrical industry, and to bring them together in harmonious action so that there may be established retail distribution of electrical materials at fair prices to the consumers, and with a fair profit to all parties taking part in the transaction.

Mr. McIntyre pointed out that since it is becoming generally recognized that the "ills of the industry" lie outside the circle of any one organization or of any one locality, therefore it would seem that a corrective movement must be national and, in fact, international in scope, so far as Canada and the United States are concerned.

Frequent calls for expressions of opinion by the members were met with unanimous and enthusiastic response, definitely showing that this is just what the local contractors and dealers need and just what they want. The General Electric Company has been asked to supply 150 copies of the booklet, "The Bridge," which will be distributed to members and to others of the local branches of the industry.

In response to a telegram from President McIntyre, a telegraphic message from Mr. William L. Goodwin to the meeting was read: "Best wishes successful meeting Toronto local contractors' association. Trust information gained at Detroit meeting will enable you to direct the energies of your

association along a line which will result in the benefit of members. Shall be pleased to lend my assistance."

A message of thanks to Mr. Goodwin for his offer of assistance was proposed and an official invitation extended to him to come to Toronto at the first opportunity to help along the movement in this district. Definite steps in this direction are being taken.

A notice of an amendment to the constitution was received which will separate the offices of the secretary-treasurer and provide for three members at large of the executive committee, making the executive committee seven in number. This change in the organization should result beneficially.

It has been reported that the Hydro-Electric Power Commission electrical inspection department will discontinue electrical inspection in the Northern Ontario district, and the president was authorized to take up this matter with the commission, to the end that no discrimination regarding inspection be allowed in different parts of the provnce, and that there should be no laxity in the requirements.

The question of licensing has been dropped for the present, as the Toronto Electrical Contractors' Association is opposed to any local law. The policy of the association as adopted will lead up to an endeavor to obtain a provincial act at the next session of the legislature.

The labor question was discussed at great length, and a general advance to the men was conceded as only fair. The negotiations with the men have proceeded during the time that has elapsed since the meeting of April 4, and a settlement has now been reached which will be announced at the next meeting.

The question of having a chartered accountant as auditor was taken up, and, upon the recommendation of the president, was adopted unanimously. It is desired to maintain a strict business policy concerning the funds of the association, and this is undoubtedly a step in the proper direction.

Nominations for Officers

Mr. Kenneth A. McIntyre was nominated for president and the nominations immediately and unanimously were voted closed. Mr. Harry Hicks, for vice-president, was accorded the same treatment.

The nominations for secretary and treasurer were deferred until the next meeting—May 2—owing to the proposed separation of these offices. Mr. E. A. Drury was nominated for the executive committee, and further nominations will be made at the next meeting, when the elections are to be held.

Ring binders for use in preserving the data sheets to be issued by the association were distributed to the members, at a price of $1.30 each.

It is the intention of the association not only to distribute the blue data sheets of the National association, but also to get out special sheets of local interest from time to time.

The next meeting is at the Walker House, May 2, at 7.30 p.m. sharp, at which the elections are to be held and the complete report given on the wage negotiations with the men.

Westmount Made a Good Showing

In the annual report of the city of Westmount, P.Q., signed by Mr. George W. Thompson, general manager, reference is made to the results of the electric light department for the year ending October 31, 1917. The total earnings were $150,563.23, of which $134,797 were derived from electric current sold, $13,210 from electric supplies sold, and $2,513 from rental of conduits. Operating expenses totalled $90,459, and, after deducting bond interest, sinking fund, etc., and reserving $22,084 for depreciation, a net profit of $18,603 is left. The report states that at the opening of the year the department was faced with an increased cost in operating. It was, therefore, quite evident that if the usual good showing was to be maintained it would be necessary to secure new business. That this was accomplished is evidenced by the increased output of 13 per cent. The electric cooking has proved a great success for the department, as well as for the user. One hundred ranges have been installed. The laying of underground conduits was only carried on in the lanes that were being permanently paved.

The Bell Telephone Company has continued the work of placing their wires underground and the removal of the poles and wires from the streets. The destructor plant has continued to give excellent results. During the year 17,639 tons of household refuse and 383 domestic animals have been consumed therein. The health department has been given a credit of $8,338 for heat value of refuse consumed.

The Clemens Electrical Corporation

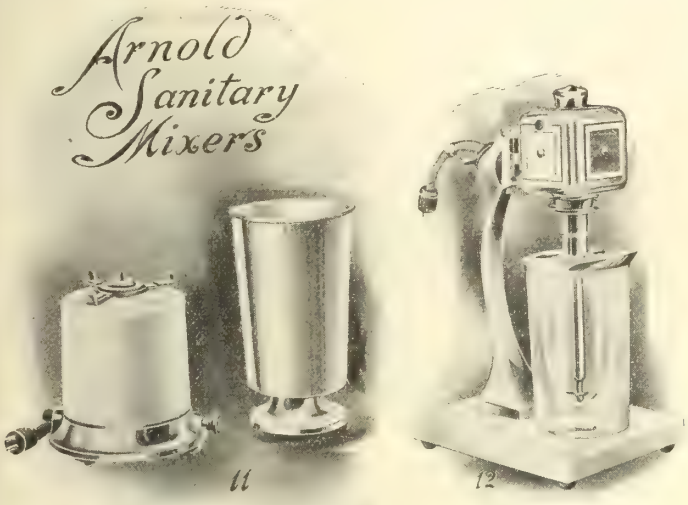
The Clemens Electrical Corporation of Canada, Hamilton, Ont., have placed on the market a new electric soldering outfit which is claimed to revolutionize the method of soldering. These tools, made in several sizes, are known commercially as the "J. C." tools. They differ from others, in that the current does not flow until the twin terminal touches the work to be heated. The terminals are of carbon, which almost immediately develops a very high temperature—up to 3,300 degrees C. As soon as the operation is completed and the tool taken from the work the current, of course, ceases to flow, as the circuit is open. The same company manufacture a copper-pointed iron which is heated on the same principle—that is, the circuit is closed by allowing the iron, operated by a spring, to come in contact with the two carbon points. When this contact has been made it is said to take less than a minute to heat the copper ready for work. This iron can also be used as a two-prong soldering tool by simply removing the tip. These tools are practically fool-proof, in that there is nothing to burn out and that the only parts requirng to be renewed are the carbon contacts. The company has distributed an attractive booklet which illustrates and describes their equipment.

Trade Consolidation

An interesting example of after-war trade organization in the engineering industry is shown by the well-known firm of Dick, Kerr & Co., Ltd., the development of whose business organization during the war has been such as to place this firm in an exceedingly strong position. For many years past Dick, Kerr & Co. have occupied a leading position as contractors for the construction and equipment of electric railways and tramways, waterworks, factories, etc., with a general engineering works at Kilmarnock and large works at Preston for the manufacture of steam turbines, electrical machnery, and electric lamps. Recently they have also taken over the control successively of the old-established business of Willans & Robinson, Ltd., of Rugby, well known as builders of steam turbines and Diesel engines, and of the United Electric Car Company, Ltd., of Preston, prominent manufacturers of railway and tramway rolling stock; and, in addition, have completed a joint manufacturing and selling arrangement with the Phoenix Dynamo Manufacturing Company, Ltd., of Bradford, in regard to certain classes of standardized electrical machinery. One effect of this unique combination of engineering interests is that while the combined technical and manufacturing knowledge of the associated firms will be available for all, yet each works can confine its output to those products for which it is best equipped. Under centralized direction the Dick, Kerr organization, with its extensive home and foreign connection will be available for the associated businesses, to the evident advantage of all. Some idea of the magnitude of the combined undertaking may be gathered from the fact that, roughly, 20,000 people are employed by the firm to-day.

The "Sanitary" Mixer

The illustration herewith shows the Arnold Sanitary Mixer now being distrbuted in Canada by R. E. T. Pringle, Ltd. In addition to the claim that it is clean and sanitary, it is said that it will mix drinks in one-third of the time required by any other machine; that none of the contents of the vessel is ever spattered about, and that the ingredients are more



thoroughly mixed—none adhering to the sides of the glass. On this account it is claimed that the Arnold will pay for itself in economies effected.

A Heavy Duty Plug

Harvey Hubbell, Inc., have designed the heavy duty polarized attachment plug illustrated herewith, which is intended to be used interchangeably with the Hubbell line of



heavy duty polarized wall and flush receptacles. It is rated at 660 watts, 250 volts. The base is constructed of porcelain and the cap is brass covered for protection against breakage. The knife blade contacts are strongly constructed, the blades being at right angles to each other to effect polarization, making the plug desirable for use in connection with instruments or other apparatus where absolute polarization is required.

Show and Demonstration Room

With a view to more adequately displaying electric and gas appliances, for which they have a large sale, the Montreal Light, Heat, and Power Consolidated have opened an extensive show and demonstration room in the old Ogilvy Building, St. Catherine Street West, Montreal. The entire lower floor has been remodelled, the front windows also being utilized for showing various fixtures and appliances and for a model room. Prior to planning the space, similar departments of many of the largest companies in Canada and the United States were visited, and some of the ideas have been incorporated in the laying out of the new showroom. A feature is the appointment room, fitted up with easy chairs and generally made very comfortable.

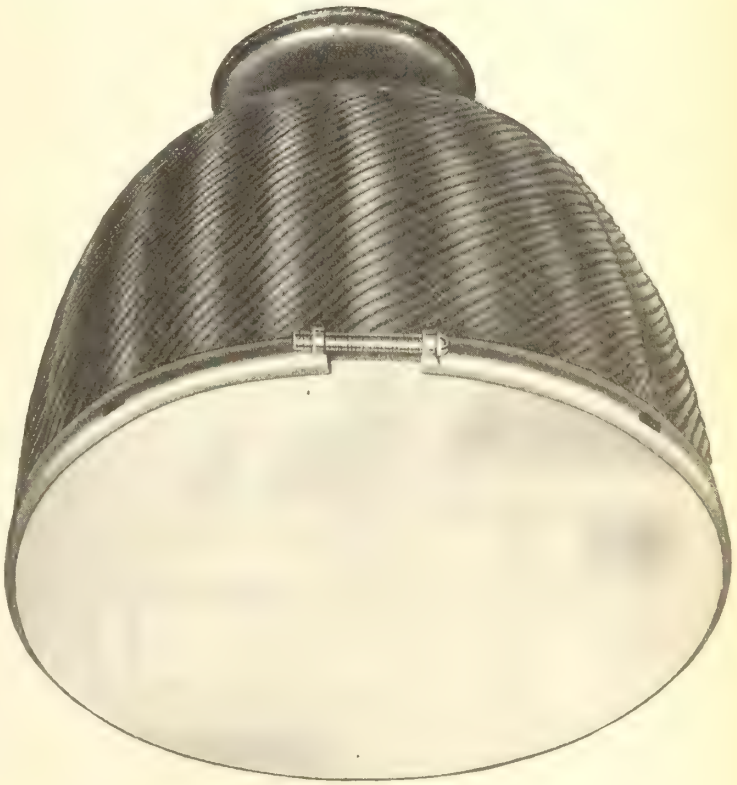
To Manufacture Ferro-Silicon

A plant for the manufacture of ferro-silicon—a new industry—is being erected at Beaupre, P.Q. The building consists of one storey, and is to be built of brick and steel. The main furnace room will be 50 x 160 feet, and will contain three 3-phase, 3,000 kw. furnaces. There are to be nine 1,000 kv.a. transformers, which will be supplied by the Moloney Electric Company of Canada Ltd. A substation is to be built. The crusher room and storage sheds will cover an area of 70 x 200 feet. A large electric travelling crane will be installed in the main building.

Mr. E. A. Wallberg, of Montreal, who is largely interested in the Laurentian Power Company, of Seven Falls, several miles below Beaupre, is at the head of the project, and Mr. James Ruddick, also of Montreal, is manager of the new concern. The plant was designed by Mr. J. M. Robertson, consulting engineer, Montreal. The company has a large contract with the Imperial Munitions Board for the manufacture of ferro-silicon, and it is expected that the plant will be in operation within three months' time, with a daily output of 36 tons, and employing a staff of one hundred or more. The contract for the steel to be used in the building has been awarded to the Eastern Canada Steel Company. The electric power will be supplied by the Laurentian Power Company. Beaupre, the site of the plant, is a short distance below Quebec City, on the line of the Quebec Railway, Light, Heat, and Power Company.

Laco-dalite to Fit All Standard Reflectors

The Canadian Laco-Philips Company is putting on the market a glass product under the trade name of "Laco-dalite." "Laco-dalite" is simply glass chemically treated and made to fit standard sizes and shapes of all reflectors on the market. It is equipped with holders permitting it to be easily attached



to such reflectors. The manufacturer believe the glass will be largely used for display purposes in department stores and for industrial lighting where color values or accurate measurements will be required.

Canadian Drill and Chuck Company

Mr Harley W. Morden has been appointed manager of the Canadian Drill and Chuck Company, and is now in complete charge of this company. They have added several new departments, and have a fine line of service boxes and motor starters. There will be a big improvement in the service, and all of the lines will be guaranteed.

Manufacturers' Catalogues

Numerous trade catalogues issued by the larger American and Canadian industrial firms are so elaborate in pictorial and descriptive detail as to partake almost of a text-book character. In many technical schools these have been found to be almost a necessary adjunct to the class text-book, in fact. The Information Department, Vocational Office for Ontario, Invalided Soldiers' Commission, 185 Spadina Avenue, Toronto, desires to obtain at once literature of this character for placement where it will do most good, and this journal is glad to pass the pointer along.

To Conserve N. S. Water Powers

Following recent conferences between Mr. J. B. Challies, superintendent of the Dominion Water Power Branch and the Nova Scotia Water Power Commission, there was introduced in the Legislature of Nova Scotia recently a comprehensive water power bill declaring the ownership of the crown, in the right of the province, of all water and water power in Nova Scotia, and providing for administrative regulations to be approved by the governor-in-council. The legislation as introduced is considered to be comprehensive and timely, and should greatly assist in the conservation and use of the many favorably located undeveloped water powers in Nova Scotia.

New Books

Telegraph Practice—by John Lee, M.A., late deputy chief inspector of telegraph and telephone traffic, London; Longmans, Green & Co., London, publishers; price $1. This book is an attempt to outline the fundamentals of telegraph practice in such a way as to indicate differences in methods as adopted by different administrations. The chapter headings are as follows: The Acceptance of Telegrams from the Public; the Centralizing of Telegraph Traffic; Telegraph Instrument Rooms; Telegraph Instruments; the Telegraph Organism; the Delivery of Telegrams; Press Telegrams; Telegraph Tariffs; the Future of Telegraph Practice. 100 pages; size, 5 x 7 inches.

Theory and Operation of Direct-Current Machinery—by Cyril M. Jansky, B.S., B.A., associate professor of electrical engineering, University of Wisconsin; McGraw-Hill Book Company, Inc., New York, publishers; price $2.50. This work is prepared to meet the needs of students with a limited mathematical training. Only the more elementary principles and methods are used, sufficient to explain the quantitative relations of the physical quantities involved in the theory of a. c. machines. The following chapter headings indicate the scope of the work: Fundamental Magnetic Principles; Electromagnetism; Electromagnetic Induction; Units of Measurement; Transformation of Energy; The Continuous-Current Generator and Motor; The Magnetic Circuit of the Direct-Current Dynamo; Armatures; Uses of Electrical Energy; Types of Dynamos; Commutation; Operating Characteristics of Generators; Operation and Care of Generators; Operating Characteristics of Motors; Operation of Three-wire Systems; Selection and Installation of Dynamos. Well illustrated; 277 pages; green cloth; size 6 x 9 inches.

Personals

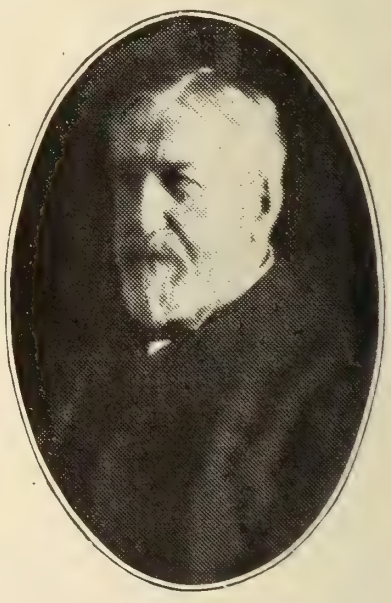
Mr. R. J. Swain, for the last 12 years electrician for the City of St. Boniface, Man., has been elected an associate member of the Canadian Society of Civil Engineers.

Mr. Arthur Gaboury, superintendent of the Montreal Tramways, has been the recipient from the French Government of the Blue Ribbon of Officer of the Academie. It is bestowed as recognition of his activities in the interests of French workmen in Montreal.

Obituary

Mr. Charles Fleetford Sise, chairman of the Bell Telephone Company and of the Northern Electric Company, Ltd., and a pioneer in Canadian electrical industries, died in Montreal on April 9, after three days' illness. He was 84 years of age. The cause of death was pneumonia, resulting from a severe chill contracted during an automobile ride. Mr. Sise was born in Portsmouth, N.H., was originally a captain in the mercantile marine, and later was engaged in the fire insurance business. In 1879 he came to Canada from Boston and organized the Bell Telephone Company, this being an amalgamation of various independent concerns. Mr. Sise was appointed managing director, and in 1890 became president, a position he held until 1915, when he resigned on account of advancing years, and was appointed chairman of the board of directors.

Under Mr. Sise's direction the Northern Electric and Manufacturing Company was formed in 1895, and four years later the Wire and Cable Company was organized, both these concerns manufacturing equipment for the Bell Company and also for private customers. In 1913 the two companies named were amalgamated, under the title of the Northern Electric Company, Ltd.

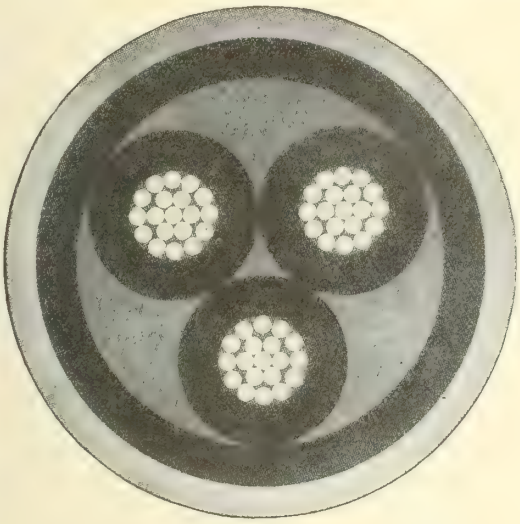


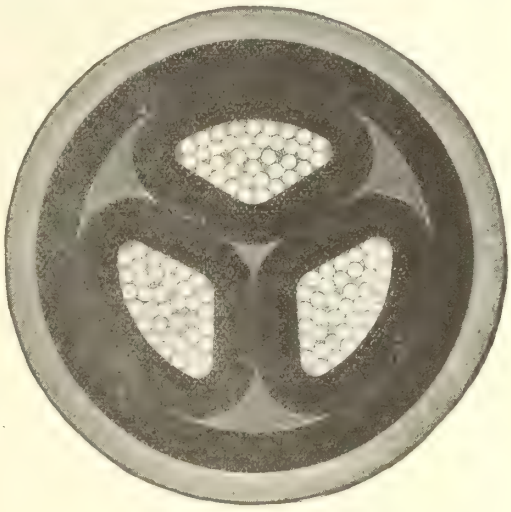
The Late Mr. C. F. Sise

Canada undoubtedly owes a great deal to Mr. Sise for his untiring endeavors to develop the telephone and also for establishing large electrical industries, giving employment to thousands of people. The important position Canada holds to-day in the telephone field is largely due to Mr. Sise's efforts. He is survived by Mrs. Sise and also leaves two daughters and three sons—Mr. C. F. Sise, Jr., general manager of the Bell Telephone Company; Mr. E. F. Sise, president of the Northern Electric Company, and Capt. Paul F. Sise, general manager and vice-president of the Northern Electric Company, who is at present in New York with the British Recruiting Mission.

PHILLIPS' CABLES

as supplied to the Toronto Hydro Electric System





These illustrations show cross sections in the original size of cables recently supplied to the T. H. E. System and reordered by them for further extensions. The specifications are as follows.—Conductors composed of 37 strands each, .082 in. diameter. Thickness of dielectric on each conductor, .210 in. Thickness in belt, .210 in. Thickness of lead sheath, .160 in. Overall diameter, 2.61 in., 250,000 C.M. Three Conductor, Paper Insulated, and plain Lead Covered Cable for 13,200 volts. We can supply you with wires and cables of any size for Power, Lighting, Telephone, Telegraph, etc.

Write us for detailed information.

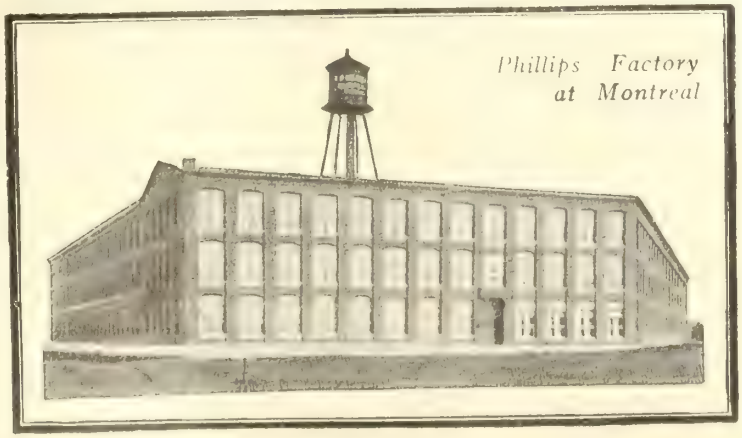
NOTE.—Specification of cable in left-hand cut: 3/0 B. and S. Three conductor. Each conductor 19 strands, each .094 in. diam. Thickness of dielectric on each conductor, .21 in. Thickness of dielectric on belt, .21 in.. Thickness of lead sheath, .15 in. Overall diameter, 2.60.

Specification of cable in right-hand cut: As stated in copy.

Eugene F. Phillips Electrical Works, Ltd.

Head Office and Factory: MONTREAL

Branches: Toronto Winnipeg Regina Calgary Vancouver



Phillips Factory at Montreal

Current News and Notes

Edmonton, Alta.

Letters patent have been issued to the Unilectric Company of Canada, Ltd.; head office, Edmonton, Alta.; capital stock, $20,000. Chester McMann is at the head of the company, which is empowered to carry on the business of electrical and mechanical engineers, electricians, contractors, and manufacturers and to deal in electrical goods, both wholesale and retail.

Guelph, Ont.

The annual report of the Guelph light and heat department shows a total revenue of $100,288 in the electrical department, with operating expenses of $85,382 and net surplus of $9,266 after providing for depreciation and interest.

Grand'Mere, P.Q.

The Laurentide Power Company have under consideration the installation at Grand'Mere, P.Q., of three additional units of 20,000 h.p. each, making the total capacity 180,000 h.p.

Kingston, Ont.

The Kingston Utilities Commission have adopted power rates of 2.4, 1.7 and .15 cents instead of the old rates of 3, 2 and 1 cent per kw. hour.

London, Ont.

Instructions from the Militia Department to give flour mills first consideration recently rendered it necessary for the London, Ont., hydro department to turn over 300 h.p. to a new mill in that city. As a result it has been found necessary to arrange a schedule under which the various factories of the city will close one hour each day. The city is divided into eight areas, and one area will be without power each hour of the working day.

Montreal.

According to the statement by Mr. J. E. Aldred, the president, the Laurentide Power Company will probably increase the capacity of the plant to 180,000 h.p., for which it was designed.

Sir Lomer Gouin has announced the personnel of the Montreal Tramways Commission as follows: President, Judge St. Cyr, of the Court of Sessions, Montreal; engineer, Louis A. Herdt, professor of Electrical Engineering at McGill University; architect, John S. Archibald, Montreal.

Eugene F. Phillips Electrical Works, Ltd., Montreal, have received an order from the Postmaster-General's Department of the Australian Commonwealth for about a million feet of paper insulated lead covered telephone cable. This is believed to be the first order from this source which has been placed in Canada. The company have also received an order for paper insulated lead covered double steel tape armoured telephone cable from the Union Government of South Africa.

Mr. R. A. Ross, consulting engineer, Montreal, has been appointed by the Quebec Government one of the commissioners of the city of Montreal. He is one of five who have charge of the civic government. The appointment came as a surprise to Mr. Ross, who was named without being consulted. He is a past vice-president of the Canadian Society of Civil Engineers and a member of the American Institute of Electrical Engineers. Mr. Ross, who was formerly a member of the firm of Ross & Holgate, is well known in the electrical field, particularly in connection with the Ontario Hydro-Electric Commission, and the development and distribution of power at Niagara Falls. Lately he has taken a great interest in the work of the Honorary Advisory Council for Scientific and Industrial Research, especially in relation to the utilization, commercially, of the large bodies of lignite in the West.

Quebec.

Another storage dam is to be erected by the Quebec Streams Commission, of which Mr. O. O. Lefebvre is chief engineer. This dam will be at Lake Brule, ten miles from Beaupre, P.Q., and sixteen miles northeast of the hydro-electric plant of the Laurentian Power Company, on the St. Anne River. The dam will give additional water power to this company. The scheme consists of a stone-filled wooden dam, 225 feet long at the crest, and two small earth dams. The pressure face of the wooden dam will be at an incline of 45 degrees. The dam will rest on solid rock.

Regina, Sask.

Superintendent Bull of the Regina electric department reports a good sale of electric ranges. At the time of the annual exhibition last summer the department inaugurated a special campaign, and since that date about 70 ranges have been installed in residences.

Sydney, N.S.

The Dominion Coal Company Sydney, N.S., contemplate several extensions and improvements to their electrical equipment during the summer months. A central station is to be erected at New Waterford, and from this point transmission lines will be run to the locations requiring current. It is expected that electricity will also replace steam for haulage purposes.

Vancouver.

The Western Power Company of Canada, which on February 1st last took over the property of the Western Canada Power Company, reports an improvement for 1917. The revenue increased from $259,250 to $331,793, a gain of $27.98 per cent. During the year the expenditure was $58,628 on completion of power plant building, installation of equipment, extension to transmission and distribution systems, etc.

Trade Publications

C. G. E. Publications—Bulletin No. 43410, "Light for the Clothing Industry," and Bulletin No. 45103 A, "G. E. Type H. Transformers"; both well illustrated.

Condulet Suggestion—No. 20, by the Crouse-Hinds Company of Canada, describing more particularly the use of condulet bodies and outlet covers in the installation of panel boards. An actual illustration is portrayed showing the wonderfully neat and workmanlike job that can be turned out with the proper use of condulets.

Safety Switches—Safety auto-lock switches are described and illustrated in some detail in special publication No. 1585-A, just issued by the Krantz Mfg. Company, Inc., of Brooklyn, N.Y. These switches are designed for use on circuits wherever the ordinary knife switch may be applied. They are especially designed for safety, it being absolutely impossible to touch the live parts regardless of the position of the switch or of the door. They are particularly adapted for use in steel mills, factories, mines and other similar locations where men are employed who have no practical knowledge of electricity.

Canada Wire & Cable Co., Limited
Head Office and Works, TORONTO

Bare and Insulated Electrical Wires for all purposes

Electric Railway Trolley Wire and Feeder Cable

Sales Offices and Branch Warehouses:
501 Merchants Bank Building, MONTREAL
592 Notre Dame Avenue, WINNIPEG
Northwestern Engineering and Supply Co., Ltd., CALGARY

Prompt shipments from Factory or nearest Warehouse

THORDARSON TRANSFORMERS
FOR EVERY PURPOSE
THORDARSON ELEC. MFG. CO., CHICAGO

MICABOND
The Standard Mica Insulation

V Rings
Cloth
Paper
Washers
Tubes
Heater Plates
Flexible Plates
Washers
Mica Insulation for Moulding and Commutator Segments

THERE is a special Micabond insulation prepared for every electrical condition.

Micabond insulations possess unusual wearing qualities and are reasonable in price.

Send us your B/P's or samples and let us figure your motor requirements.

Chicago Mica Co.
VALPARAISO, Ind.
Address Dept. D.



Bermico
kyanized
Cross Arms, Poles,
and Ties *are*
protected from decay.
Manufactured in our own plant from carefully selected stock
write for samples and particulars

BROWN COMPANY
Founded 1852
PORTLAND, MAINE

Tenders

A few dollars spent in advertising your proposals in

The Contract Record

would result in additional competition, which might save your city or town or your client many hundreds of dollars.

ALUMINUM
ELECTRICAL CONDUCTORS

Ingot Sheet Wire Rod Tubing

Northern Aluminum Co., Limited
1305-6 Traders Bank Bldg.
Toronto, Ont.

WANTED Draftsmen with experience on transformers, induction motors, or direct current machines. Apply stating experience and salary expected, to Box 731, Electrical News, Toronto. 9-11

Cable For Sale

8742 lbs 1,000,000 C.M. Triple Braid Wacco Cable, 2500 feet.
3531 lbs 500,000 C.M. Triple Braid Wacco Cable, 1755 feet.
Subject to immediate delivery and prior sale.
Box No. 707, Electrical News, Toronto. F

Accident Prevention Hints

Line construction and repair work are done by linemen reporting to headquarters. These linemen, working on street lighting circuits or other circuits which must be interrupted for them, should be adequately protected against the possibility of the switch being inadvertently closed. Because of the fact that there is no regular operator in attendance this problem is difficult, but the following solution is suggested, after a trial of a number of years in several sub-stations:

A leather envelope is used as a tag to be hung on the switch controlling the circuit to be protected. On one side of this envelope is printed the customary warning that men are working on the circuit. Within the envelope is a card properly arranged to receive full information as to the time the tag is placed and removed from the circuit, for whom it is so placed and for what purpose. The workman wishing to be protected makes his record on the card and hangs and removes the tag himself. Two or more gangs working on the circuit at the same time have equal protection, the last one to clear from the circuit removing the tag.

Lightning Arresters

Aluminum-cell lightning arresters have been very generally used for a number of years for the protection of distribution and transmission lines. They have been found to be highly efficient and require little attention, while it has been the prevailing opinion that their use introduces a negligible hazard. A recent fatal accident involving one of these arresters is worthy of attention.

It was found upon investigation that the charging mechanism was so arranged as to make it possible to leave it in the charging position, the charging contacts being found closed when the investigation was made. Evidently the man who had charged it ten hours earlier had left it on charge. The temperature of the oil had slowly risen until the film had disintegrated, allowing a rush of current and an arc, which exploded the oil in one of the tanks and tripped out the circuit. The operator at the source end of the line restored the circuit after a lapse of one minute, which was customary. About four minutes from this time the second tank exploded, with the result mentioned. The lessons to be learned from this incident are:

(a) Aluminum cell arresters under certain conditions become a grave accident hazard.

(b) Charging mechanism should be so arranged as to make it impossible to leave the arrester on charge.

(c) Frequent checks should be made to determine the amount of current passing through the arrester when charging. —N.E.L.A. Bulletin.

PETRIE'S LIST

of New and Used

MOTORS

for Immediate Delivery

No.	H.P.	Phase	Cycle	Volts	Speed	Maker
1	50	3	25	550	720	Westg.
1	40	3	25	550	750	C. G. E.
2	40	3	25	550	710	Westg.
2	35	3	25	550	720	Westg.
1	30	3	25	550	710	Swedish
1	25	3	25	2000	900	C. G. E.
2	20	3	25	550	710	Westg.
1	20	3	25	550	500	C. G. E.
4	15	3	25	550	750	C. G. E.
1	10	3	25	550	750	C. G. E.
4	10	3	25	550	720	Westg.
1	7½	3	25	550	720	Westg.
2	7½	3	25	550	750	C. G. E.
1	5	3	25	550	1440	Excelsior
2	4	3	25	550	1400	Excelsior
2	3	3	25	550	750	C. G. E.
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1	½	G.E.	110	I	1800
5	1	G.E.NEW. .	220	KT	1800
1	1	G.E.	220	KT	1800
1	1	Fbks. M. ..	440	B	1200
2	2	G.E.	220	KT	900
5	2	G.E.NEW. .	220	KT	1800
5	3	Wstgh. New	220	CS	1130
2	3	R&M NEW.	220		1150
4	3	G.E.	220	KT	1800
6	3	G.E.NEW. .	220	KT	1800
1	3	G.E.	220	KT	900
3	3	G.E.	220	KT	1200
1	3	Cr.Wh. . . .	220		1720
6	5	G.E.NEW. .	220	KT	1800
1	5	G.E.	220	KT	1800
1	5	G.E.	220	KT	1200
3	5	Cr.Wh. . . .	220	Q	1720
1	5	Cr.Wh. . . .	550	Q	1720
1	5	Wstgh.	220	CCL	1700
10	5	Wstgh. New	220	CS	1735
3	5	Wstgh. New	220	CS	1130
29	7	G.E. (motors only)	550		1200
1	7½-15	Cr.Wh..	220/440		865/1735
3	7½	G.E.NEW. .	220	KT	1800
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6	7½	G.E. (motors only)	550	KT	1800
2	7½	G.E.NEW. .	220	KT	900
2	10	G.E.NEW .	220	KT	1800
4	10	G.E.NEW. .	220	KT	1200
1	10	Wstgh.	220	CCL	1700
1	10	Wstgh. . . .	220	CS	1150
1	10	Cr.Wh. with resistance type starter	550	Q	1800
3	15	G.E.NEW. .	220	KT	1200
2	15	G.E.NEW. .	220	KT	900
3	15	R&MNEW.	220		1150
3	15	Fbks.M.	220/440	KBV	1200
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50	20	Fbks.M.	220/440	KBV	1200
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1	40	Wagner NEW.	220/440	BP	850
1	40	Fbks.M. . .	220		900
2	40	G.E.NEW. .	220	KT	1200
1	50	Triumph . .	220		720
1	50	G.E.NEW. .	220	KT	900
2	50	G.E.NEW .	440	KT	900
1	75	G.E.NEW. .	220	K	900
1	125	G.E.	2200	L	600
1	150	Wstgh. New	440	CW	695
1	150	G.E.NEW. .	220	M	580
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6	15	Allis-Ch. ..	220		750
7	20	Allis-Ch. ..	220		750
2	20	G.E.	440	K	750
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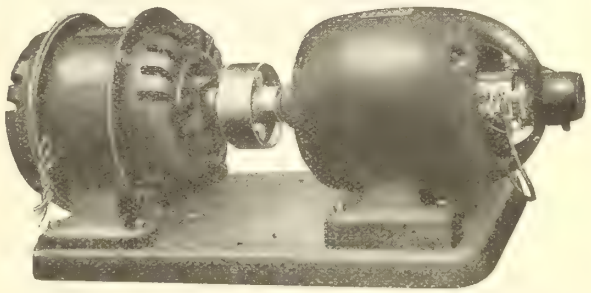
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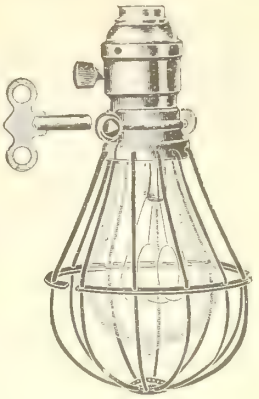
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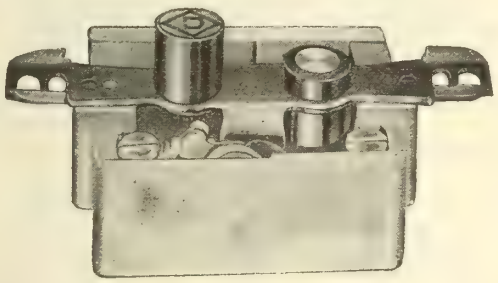
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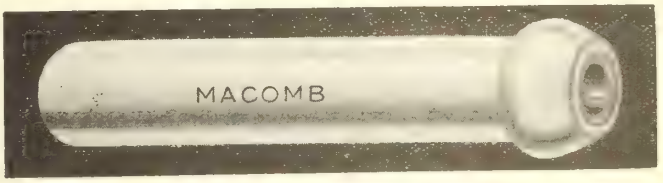


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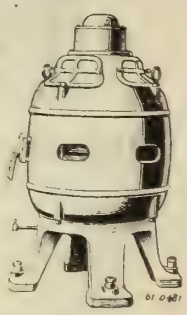
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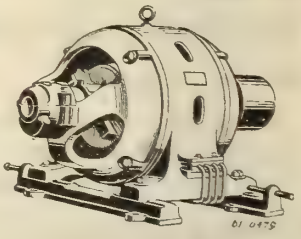
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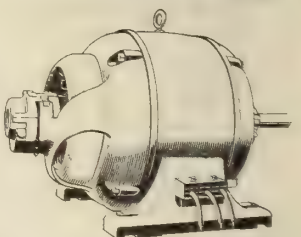
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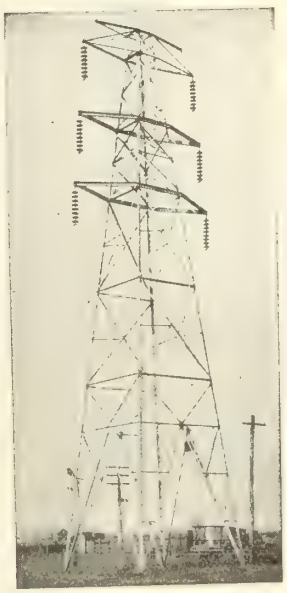
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CAR EQUIPMENT
Ohio Brass Company

CENTRIFUGAL PUMPS
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Canadian Allis-Chalmers Company

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Jones & Glassco

CHARGING OUTFITS
Canadian Crocker-Wheeler Company
Canadian General Electric Company
Lincoln Electric Company of Canada
Pringle, R. E. T.

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Cutter Electric & Manufacturing Company
Ferranti Electrical Company of Canada
Northern Electric Companny
Sundh Electric Company

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Cleveland Armature Works
D. & W. Fuse Company

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Redmanol Chemical Products Company

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Bradstreet Company

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Cleveland Armature Works

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Northern Aluminum Company

CONDUITS
American Conduit Company
Conduits Company
Flexible Conduit Company
National Metal Molding Company
Northern Electric Company
Orpen Conduit Company

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Canadian General Electric Company
Canadian Westinghouse Company
Electrical Maintenance & Repairs Company
Sundh Electric Company

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Dossert & Company

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Canadian Westinghouse Company
Flexible Conduit Company
National Electric Heating Company
Northern Electric Company
Renfrew Electric Company
Spielmann Agencies, Registered
Superior Electrics Ltd.

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Phillips Electrical Works, Eugene F.

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Boving Hydraulic & Engineering Company

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See Directory of Engineers.

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ELECTRIC SHADES
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ELECTRIC RANGES
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National Electric Heating Company
Northern Electric Company

ELECTRIC RAILWAY EQUIPMENT
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Crouse-Hinds Company of Canada, Limited.
Electric Service Supplies Company
Ohio Brass Company

ELECTRICAL TESTING
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Century Electric Company
Great West Electric Company
Northern Electric Company
Pringle, R. E. T.
Robbins & Myers

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Spaulding & Sons Company, J.

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Northern Electric Company

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Tallman Brass & Metal Company

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Detroit Fuse & Manufacturing Company
Economy Fuse & Manufacturing Company
G. & W. Electric Specialty Company
Hatheway & Knott, Inc.
Moloney Electric Company of Canada
Northern Electric Company
Square D Company

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CANADIAN PORCELAIN CO.

LIMITED

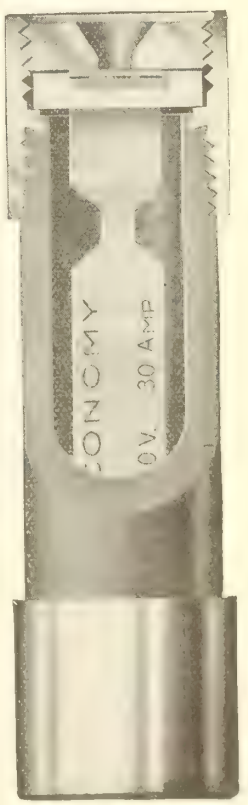
HAMILTON - CANADA

Manufacturers of High and Low Tension Porcelain Insulators

ECONOMY

RENEWABLE

FUSES



protect millions of circuits and billions of dollars worth of property in thousands of plants representing every branch of industry.

They are used by the U. S. Navy, leading powder and munitions plants, ship yards, steel mills and others who put accuracy and safety before anything else.

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No special tools or experience needed to replace the link and renew the fuse. Anyone can do it in a jiffy.

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Manufacturers in Canada of { "ARKLESS"—The Non-Renewable Fuse with the "100 per cent. Guaranteed Indicator."
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Lancashire Dynamo & Motor Company
Lincoln Electric Company of Canada
Power Plant Equipment Company
Railway and Power Engineering Corporation
Thomson Company, Limited, Fred
Toronto & Hamilton Electric Company

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McGill Manufacturing Company

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Chicago Mica Company
Kent Bros.
Mica Company of Canada

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Petrie, Limited, H. W.
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Robbins & Myers
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Sachsenmaiere Company, Geo.
Thomson Company, Limited, Fred
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Wagner Electric Mfg. Company of Canada

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McGill Manufacturing Company
Spielmann Agencies, Registered.
Standard Underground Cable Co. of Canada

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Fetherstonhaugh & Hammond
Marion & Marion
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Illinois Electric Porcelain Company
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Electrical Development & Machine Company
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Joyner, Limited, A. H. Winter
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Boving Hydraulic & Engineering Company

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Electrical Maintenance & Repairs Company

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Electrical Maintenance & Repairs Company
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Canadian Westinghouse Company
Sundh Electric Company

RODS
International Nickel Company

ROSETTES
Benjamin Electric Manufacturing Company
Duncan Electrical Company
National Metal Molding Company
Northern Electric Company
Pringle, R. E. T.

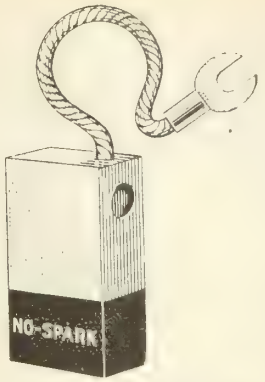
SOCKETS
Benjamin Electric Manufacturing Company
Canadian General Electric Company
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Duncan Electrical Company
National Metal Molding Company
Northern Electric Company

(Continued on Page 56)

The Chief Benefit

derived from

"No Spark"



CARBON BRUSHES

IS FREEDOM FROM TROUBLE REPLACING AND RESETTING BRUSHES. Being self-lubricating, they make the contacts practically frictionless and reduce commutator repairs enough to pay for themselves several times over. With these carbon brushes, the machine runs noiselessly without any sparking. These are facts which you can at once prove.

Write for our latest Bulletin

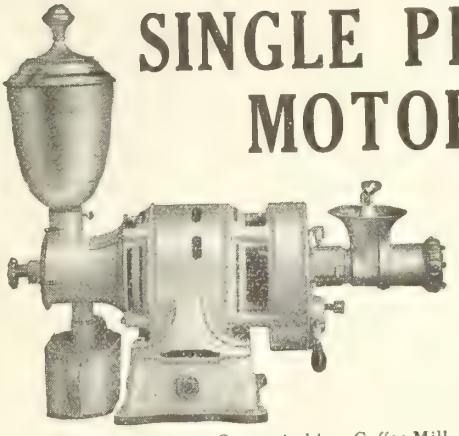
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Self-Lubricating Carbon Co.
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In Congested Districts Where Many Consumers Are Served From One Secondary, The Low Starting Current (Less Than Three Times Full Load Current) of

Century

Repulsion Start Induction

SINGLE PHASE MOTORS



½ H.P. Motor Direct Connected to a Coffee Mill and Meat Chopper

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1 10 to 40 h.p. sizes

CENTURY ELECTRIC COMPANY
ST. LOUIS, Mo., U.S.A.

270

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Rankin & Cherrill, 55 Hastings St. W., Vancouver, B.C.

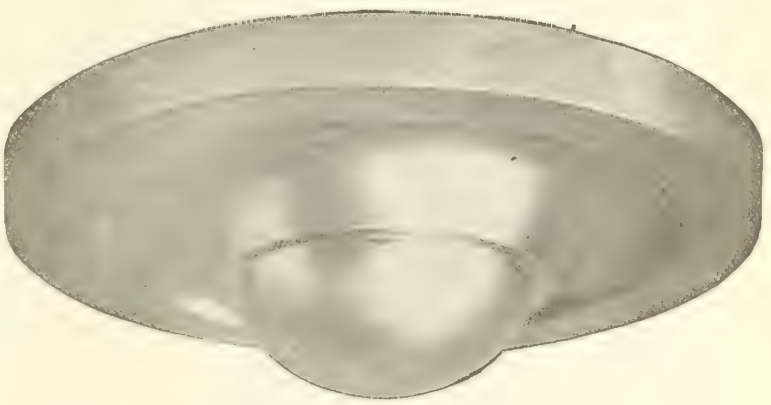
Stamped Fixture Pans

No. 218—10 in. and 12 in.

For the

Dealer and Jobber

Have you seen this new Stamped Pan? Secure one to-day and compare it with the ordinary spun pan. Note the fine, sharp lines and smoothness of metal, found only in our product, which is always found wanting in the case of the spun pan.



Our Finishes are Brushed Brass, Flemish Old Brass, Rich Gold and Matt.

DELIVERIES ARE GOOD. PRICES BETTER.

W. H. BANFIELD & SONS, LTD., TORONTO, CAN.

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Northern Electric Company

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Branston & Company, Chas. A.

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Onward Manufacturing Company

WATER POWER MACHINERY
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Smith Company, S. Morgan

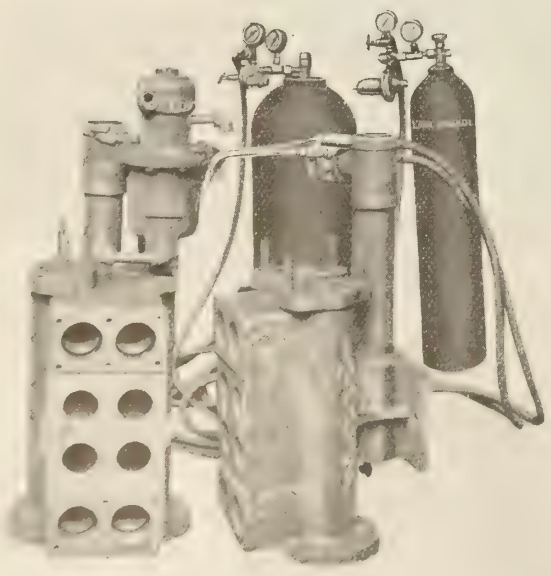
WATER WHEELS
Canadian Allis-Chalmers Company

WELDING EQUIPMENT
Lincoln Electric Company of Canada

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Canada Wire & Cable Company
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Saved by Oxy-Acetylene Welding



These two pumps were cracked in about 20 places by frost. A few years ago they would have been condemned as useless, but the most efficient, economical, and practical method is to weld them, which was done in this instance, and they are now giving as good service as ever.

There are many similar uses to which the Oxy-Acetylene Process may be profitably employed in your Industry, and our years of experience as Manufacturers of Apparatus of the highest efficiency and the necessary gases enables us to give you unequalled service in all matters pertaining to the Process.

Your enquiries are solicited, and will receive immediate attention.

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The Pioneers of the Process Throughout the World

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Simplicity

Lincoln Arc Welder

The Lincoln Arc Welder is a simple machine which any one can understand and operate.

The motor is a standard Lincoln Machine, designed to operate on the kind of electric current you use.

It is direct connected to a generator which delivers electric current at the proper voltage for welding.

The control panel mounts the two necessary meters, a small hand wheel for regulating current and the simple knife switch connections.

The stabilizer is an electric magnet which gives stability to the current and makes the arc easier to control.

Insist on simplicity when you buy a welder.

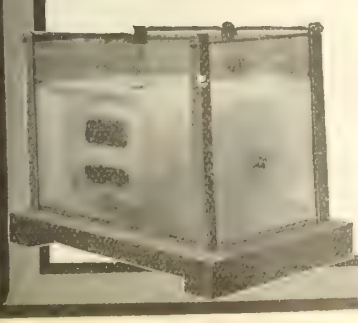
ASK FOR WELDING BULLETIN
"LINK UP WITH LINCOLN"

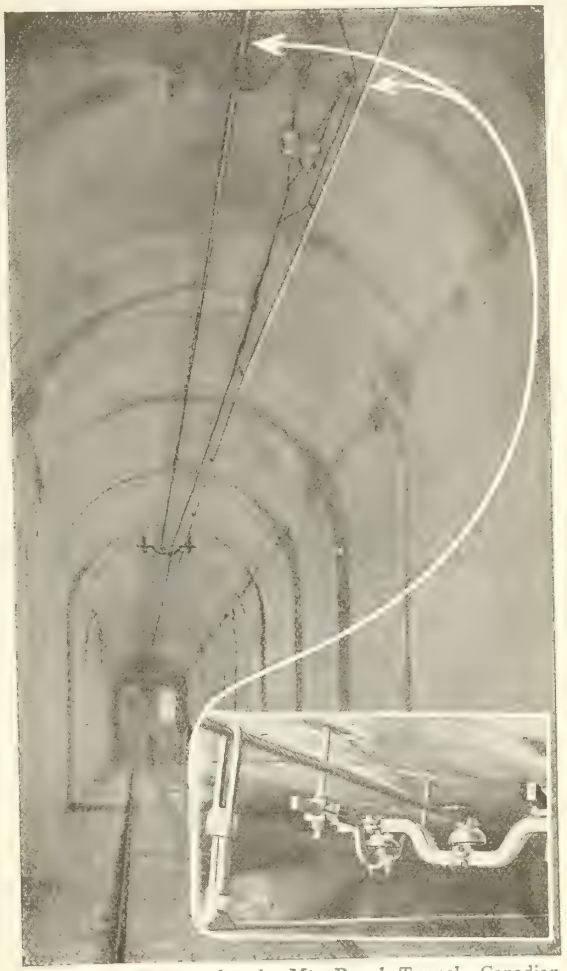
Lincoln Electric Co.

of Canada, Limited

Head Office
311-312 Kent Building
TORONTO
Ontario

Branch Office
MONTREAL





Overhead Construction in Mt. Royal Tunnel, Canadian Northern Terminal Electrification, Montreal, Can.
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Special Standard Bronze
(S. S. B.)
High Strength Trolley Wire

was used in this electrification because, after rigid tests by unbiased engineers and careful comparison of results with similar tests on hard-drawn copper and steel, the superior strength, rust- and wear-resistance of S. S. B. Wire were found to meet every requirement of a service characterized by great extremes of temperature and hard usage.

The clearance in this tunnel is only 16 feet and the messenger cable had to be kept under great tension so as to flatten the catenary and reduce the sag to a minimum. S. S. B. Wire was, therefore, used here for both trolley and messenger.

S. S. B. Wire can be supplied in 40 and 60% conductivities as compared with copper.

Write our nearest office for samples and prices

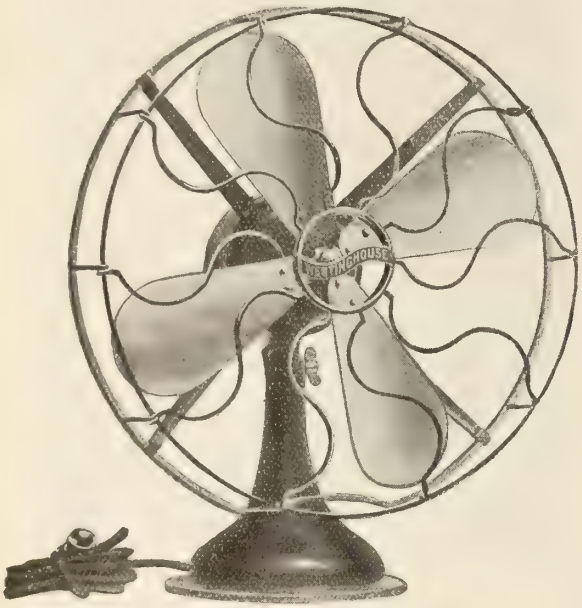
Standard Underground Cable Co.
of Canada, Limited
Hamilton, Ont.

Montreal · Toronto - Hamilton Seattle

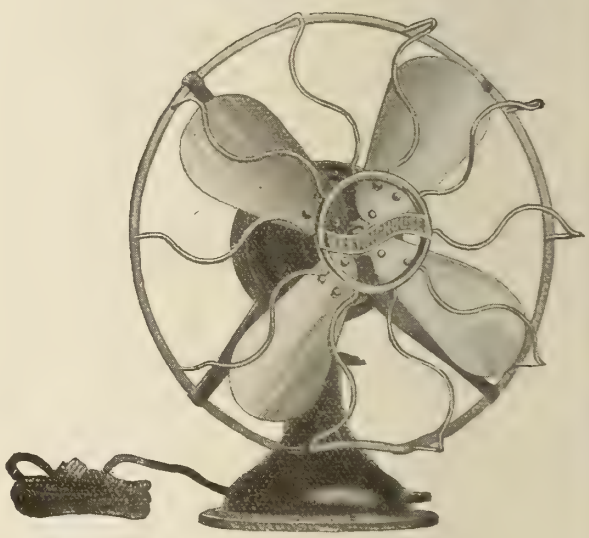
Westinghouse

Electric Fans

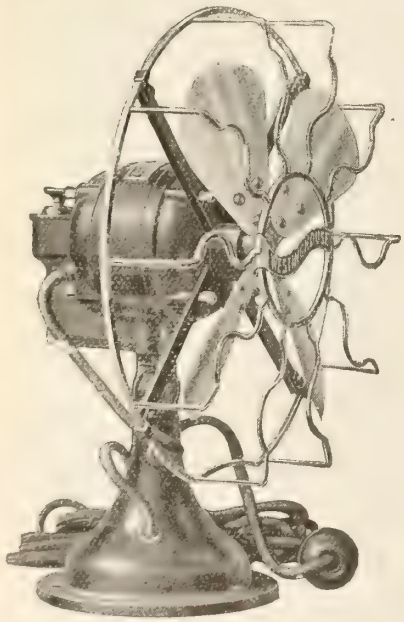
Season 1918



16 in. Desk and Bracket Fan.



12 in. Desk and Bracket Fan.



12 in. Oscillating Fan.

Have Them on Hand

You cannot depend on getting electric fans in a hurry next summer,—Even the express service is slow, nowadays.

There is only one sure way to have fans when you need them, and that is to have them on hand.—Order now.

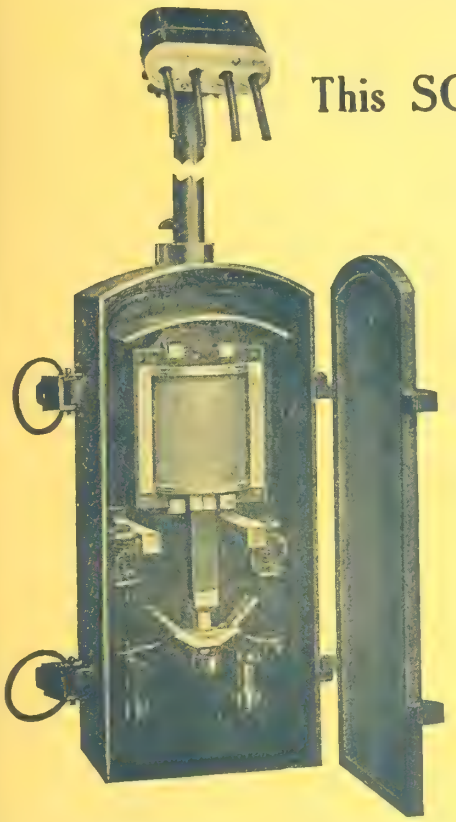
The Westinghouse Line of Fans is complete

Non-Oscillating Desk and Bracket, 8, 10, 12 and 16-inch.
Oscillating Desk and Bracket, 10, 12 and 16-inch.
Gyrating, Ceiling, Counter-Column and Floor Column.
Ceiling, 56-inch.
Exhaust, 12 and 16-inch.

Send for Folder No. 8-A.

Canadian Westinghouse Co., Limited, Hamilton, Ontario

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This SOLENOID SWITCH has been adopted by the Hydro Electric Commission

They use it for

STREET LIGHTING

Now the fact that it is used by the Hydro-Electric Commission is proof that it is all we claim for it. It certainly is not an experiment. by the fact that it is giving efficient service in many towns throughout Ontario, as well as the other provinces.

No springs, swivels or other complicated mechanisms to give trouble. They close magnetically and are opened by gravity assisted by the tension of the laminated copper contact. All arcing is taken up on the carbons.

Increase the efficiency of your system and decrease the cost of installation by using our Type 17 H.E.P. Solenoid Switches, which are suitable for any frequency on multiple circuit or D.C. Series circuit.

Write for complete descriptive particulars

The Electrical Maintenance & Repairs Company, Limited

Phone Adelaide 902-903

162 Adelaide Street West
TORONTO

Nights Beach 1723-1930

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ENGINEERS

MONTREAL AND TORONTO

Specialists in

POWER TRANSMISSION CHAINS

CANADIAN AGENTS FOR

"RENOLD"
Patent Silent and Bush Roller Chains

"MORSE"
Rocker Joint Silent Chains

CHAIN DRIVES FROM 14 H.P. TO 5000 H.P. IN SUCCESSFUL OPERATION

Write for particulars to

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Branch Office:
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We can keep you running
while we make your repairs

FRED THOMSON CO., LIMITED

326-328-330 WEST CRAIG STREET
MONTREAL

G&W ELECTRIC SPECIALTIES

The Essential Details of G & W DISTRIBUTION BOXES

are very carefully perfected

In the primary box illustrated, switch blade action is combined with bolted contact efficiency

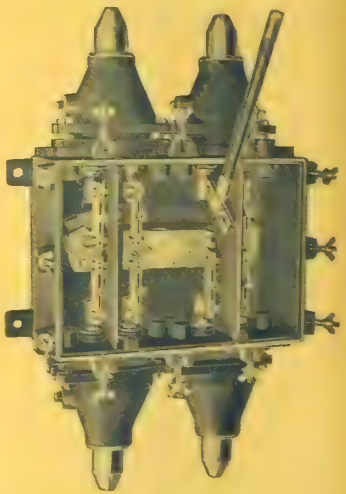
Unit cable potheads with ample compound space make an easy installation without sacrifice of safe, permanent cable end insulation.

The entire box is lined with insulating material—all bolt heads, etc., are covered and different polarities are thoroughly barriered.

In the secondary box double U clips give better contact alignment than would a single U clip.

The unit cable potheads attach at an angle, gaining roominess without using excessive wall space.

The line of this material is complete, offering constructions suitable for all conditions.



Primary Box for 2300 Volt Use

Let us quote you on your requirements

G & W ELECTRIC SPECIALTY CO.
7440-52 So. Chicago Ave. CHICAGO, U.S.A.

A. H. Winter Joyner, Ltd., 100 Wellington St. W., Toronto.
A. H. Winter Joyner, Ltd., 17 St. John Street, Montreal.
Bentz-Richardson Co., Ltd., 592 Notre Dame Ave., Winnipeg.
General Supplies, Limited, Calgary and Edmonton.



Secondary Box for Low Tension Use

Vol. XXVII No. 10 Toronto, May 15, 1918

Electrical News

Generation, Transmission and Application of Electricity

STANDARD UNDERGROUND CABLE CO. OF CANADA, LIMITED

General Offices and Works: Hamilton, Ont.

WE solicit your inquiries for the following products:

Bare Copper, Brass and Bronze Wires
Colonial Copper Clad Steel Wire
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Varnished Cambric Insulated Cables
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Rubber Insulated, Lead Covered Cables
Steel Wire and Steel Tape Armored Cables
Outdoor and Indoor Cable Terminals
Cable Junction Boxes
"Ozite" Insulating Compounds,
etc.

For complete information, prices or estimates, write our nearest branch office.

MONTREAL TORONTO HAMILTON SEATTLE

HUGHES
Electric Ranges

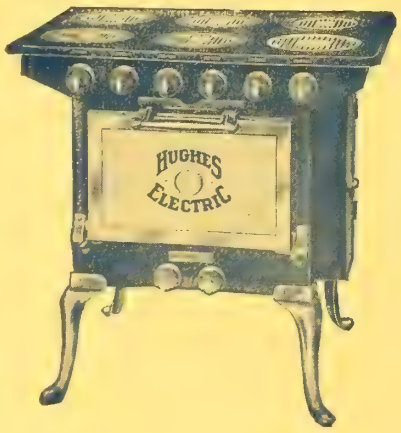


No. 50

HUGHES "50" ELECTRIC RANGE

This is one of the most popular styles of ranges on the market. Ideal for homes, suitable for medium or large size family, also for Clubs, Church Kitchens, etc.

Features, 4-burner cooking surface, 2-burner oven, warming compartment, outside warming shelf, lower outside shelf. Finish either plain or nickled with white enamel splashers.



No. 48

HUGHES "48" ELECTRIC RANGE

Extremely handy; designed for large families, boarding houses, restaurants, hotels, clubs, etc., where a greater cooking capacity is required in a small space.

Features, 6-burner cooking surface, 2-burner oven. Finish either plain or nickle plated.

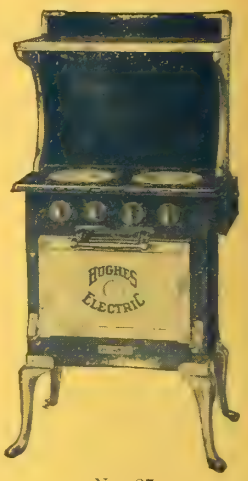


No. 44

HUGHES "44" ELECTRIC RANGE

A very popular range because it uses little floor space and has elevated oven, exclusively for families of average size.

Features: 4-burner cooking surface, 2-burner oven, lower outside shelf. Finish either plain or nickle plated.



No. 27

HUGHES "27" ELECTRIC RANGE

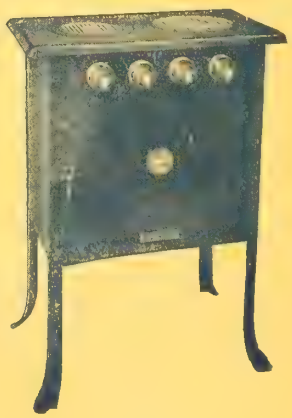
The most desirable Range for small or medium size families with limited kitchen space.

Features, 2-burner cooking surface, 2-burner oven, elevated outside warming shelf. Finish either plain or nickle plated.

Electricity Makes Cooking Scientific and Economical

SCIENTIFIC—because they have introduced and adopted, virtually, every fundamental improvement in the development of the modern electric range—the most complete line of electric cooking apparatus in the world.

ECONOMICAL—because of economy of current, of food, of time and trouble. The HUGHES ovens are so constructed as to make it possible to turn off the current long before the food is cooked; because it does not shrink or dry out the food it cooks, hence an appreciable saving in market bills.



No. C-18

HUGHES RANGES are sold with a year's guarantee against defects electrical and mechanical, backed by the reputation of their makers. They are without doubt the best and most economical electric ranges on the market.

Awarded GOLD MEDAL, Panama Pacific International Exposition, 1915.

Tested and approved by the Underwriters' Laboratories of the National Board of Fire Underwriters—and also by Good Housekeeping Institute.

Write our House nearest you for further information as to literature, prices, etc.

HUGHES "C-18" ELECTRIC RANGE

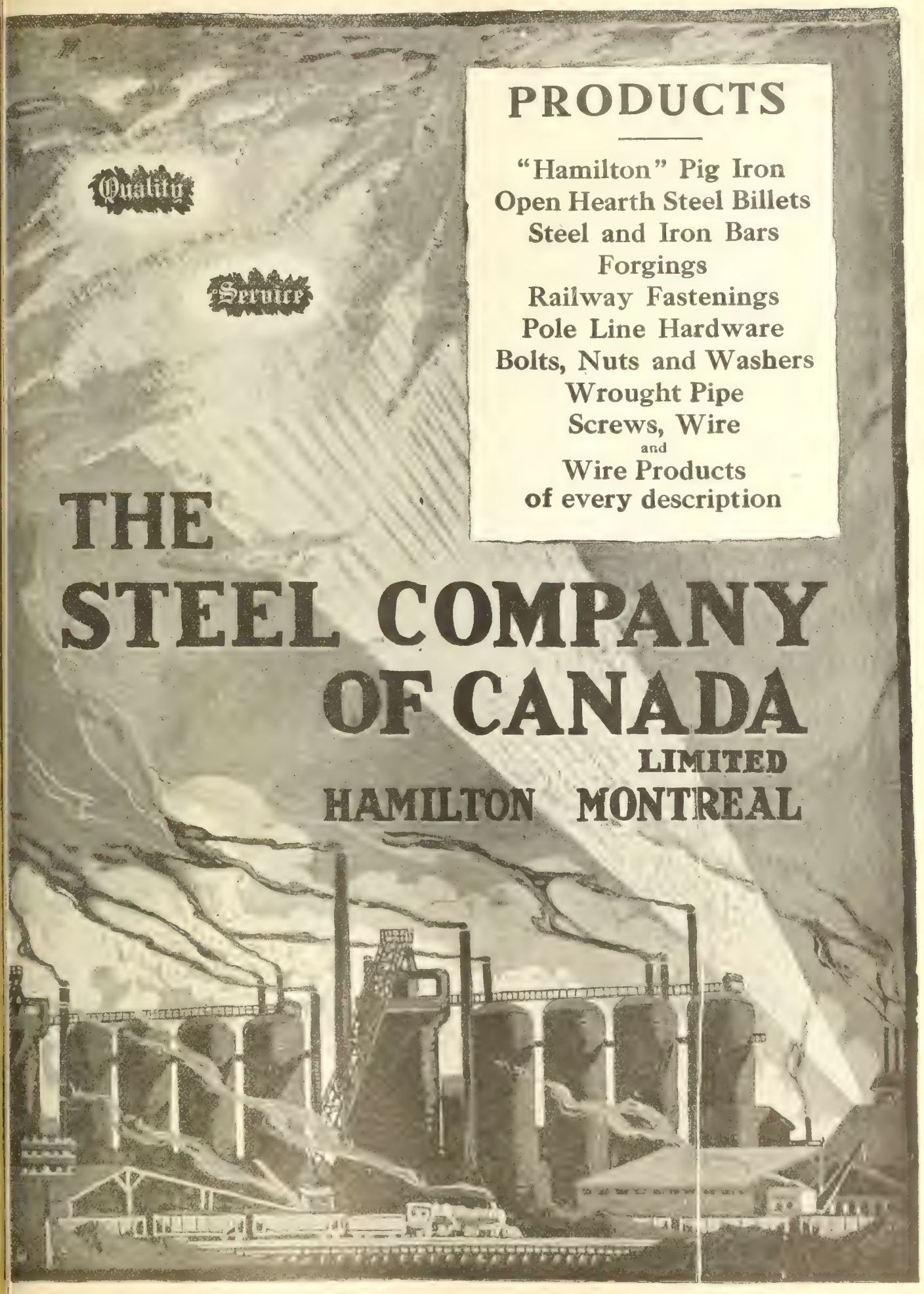
It is solidly constructed of steel and cast iron, occupying floor space of only 17 x 25 inches, compact, neat, most suitable for light cooking. Finish plain black enamel.

Northern Electric Company
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HALIFAX
OTTAWA

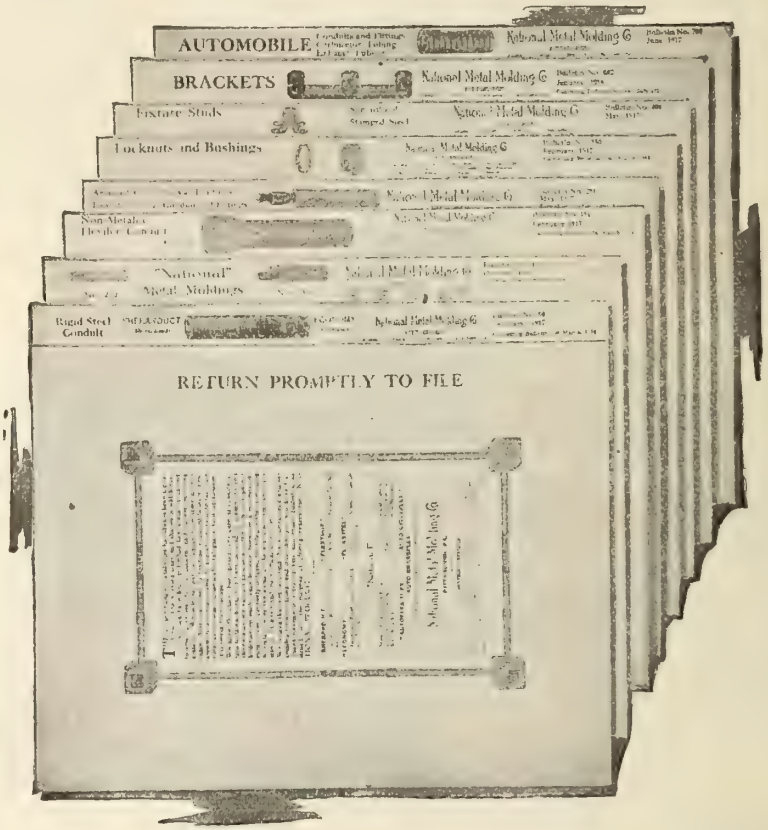
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of every description
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BULLETIN 201—FLEXSTEEL PRODUCTS
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Any or all sent promptly on request

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Manufacturers of
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Portland Salt Lake City San Francisco Seattle St. Louis Buenos Aires Havana Manila Paris

Canadian Distributors—Canadian General Electric Company, Limited

Four 250 foot coils packed in a strong fibre box to make it easy to handle and economical to store.

Northern Electric
DURADUCT
(Reg. Can. Patent Office)

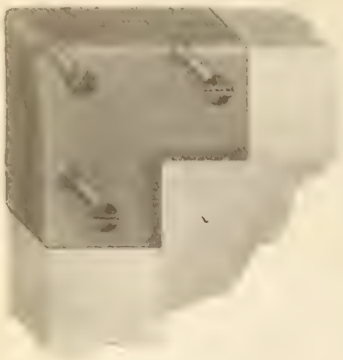
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All reliable dealers sell it.

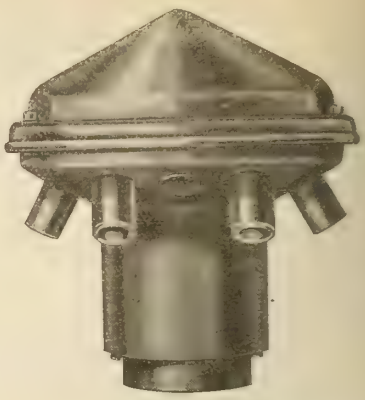
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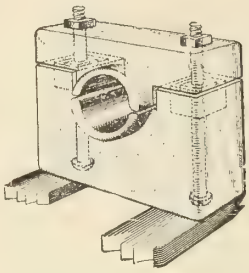
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IS THE MARK OF
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"FRANKLIN" Cable Potheads
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Lighting and Power Transformers
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To secure prices give us K. W. capacity, voltage, cycles, transformers required.

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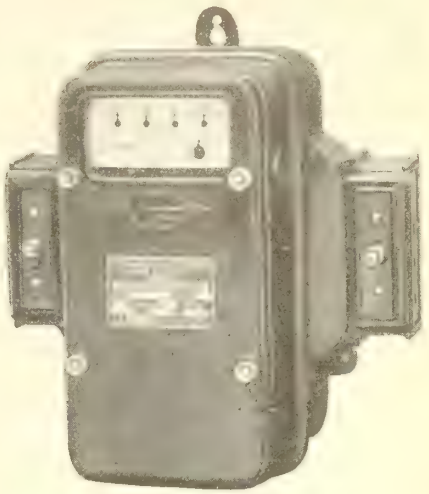
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Built On The Right Lines

By Canadian Workmen

This C. & H. Poly-Phase Meter



For instance, inside you will find that the room for making connections is much greater than is found in most meters.

Another outstanding safety feature is the use of Double Terminal Blocks, removing the danger of accident when the wires are subjected to heavy overloads and surge conditions during lightning storms.

This "safety first" principle has brought the C. & H. Polyphase into almost universal use.

Note: The wires are connected directly through the meter from left to right.

First, last and all the time this Polyphase Meter is dependable. We are building meters of quality, not price cutters.

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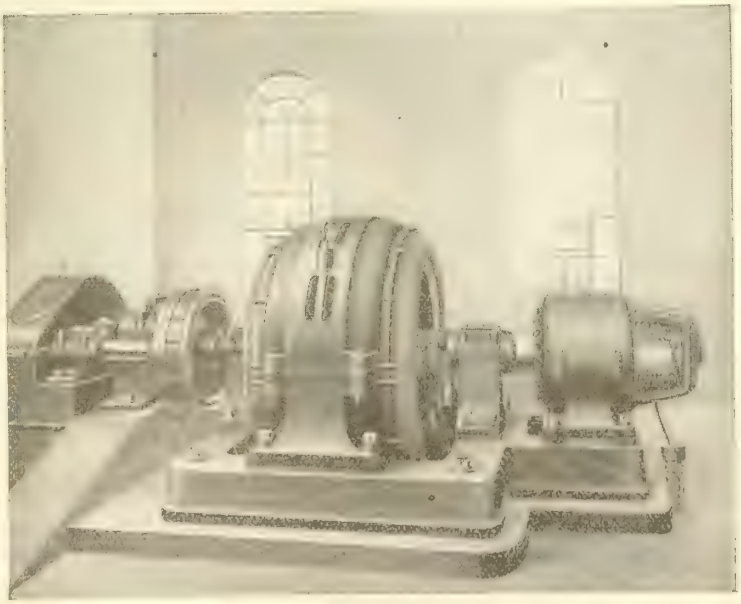
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We have a large stock of motors up to 100 H.P. in Toronto ready for immediate delivery

The "Lancashire" Ball Bearing Induction Motor and "Patent Reversing Drive for Metal Planers," will repay investigation.

Descriptive matter sent on request.



350 H. P. Self Starting Synchronous Motor Driving Colliery Ventilating Fan.

Accidents will happen, but a complete stock of spare parts and well equipped repair shop ensure users of "Lancashire" machines, minimum inconvenience from such breakdowns.

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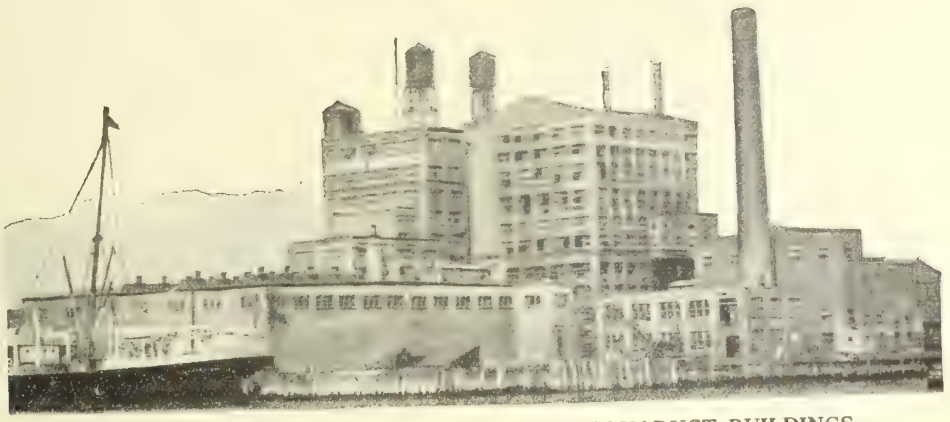
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A high-class interior construction conduit of the enamelled type, proof against acid or other corrosive agents.

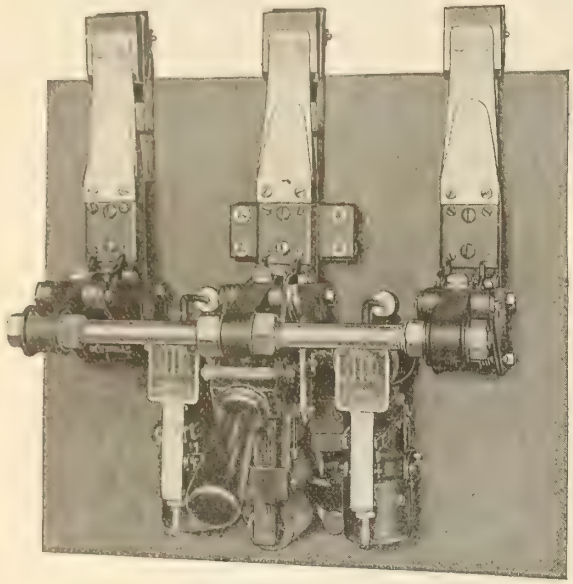
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TYPE W

Non closable on overload. Direct acting, time limit and "No Voltage."

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Pole Type Transformers

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HIGH EFFICIENCY— LOW CORE and COPPER LOSSES

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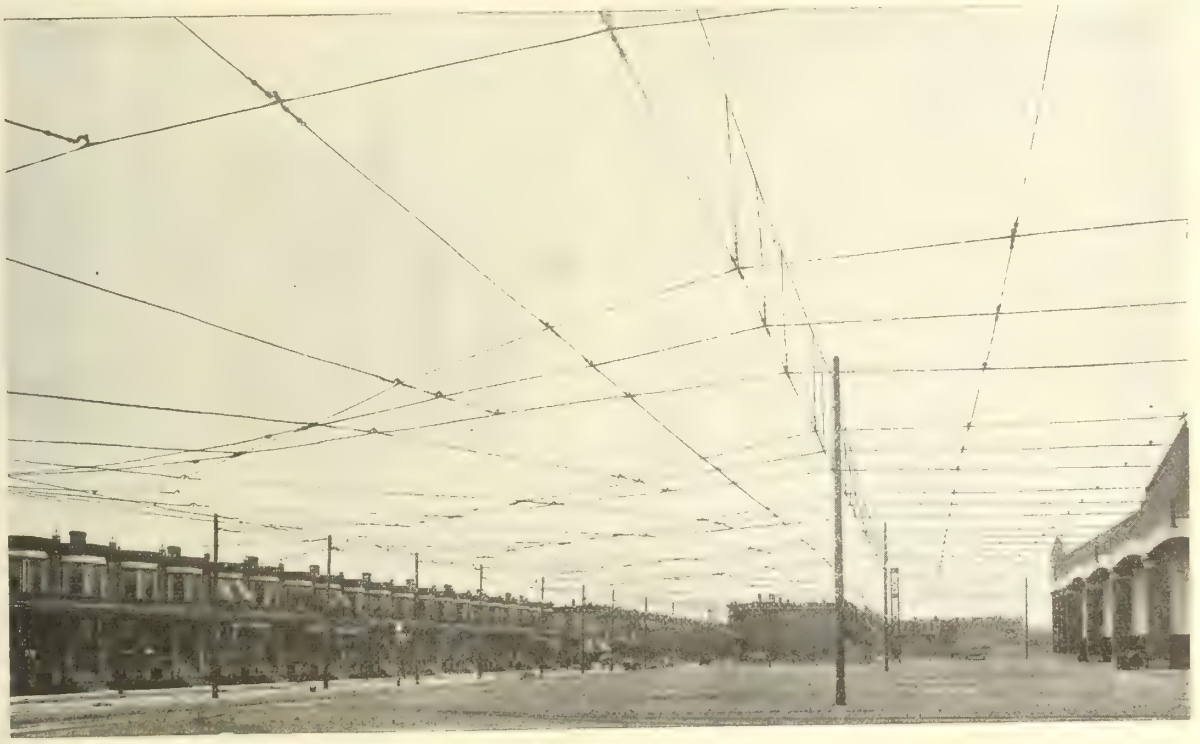
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Just write a letter and explain your problem.

The Ohio Brass Company

MANSFIELD, OHIO

LINCOLN MOTORS

For Chemical Plants

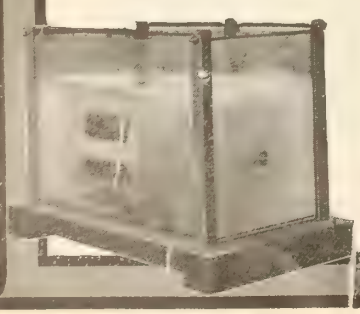
The insulation on Lincoln Motors protects the windings against damage from acids, alkalies, and other chemical solutions.

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Stability and Efficiency

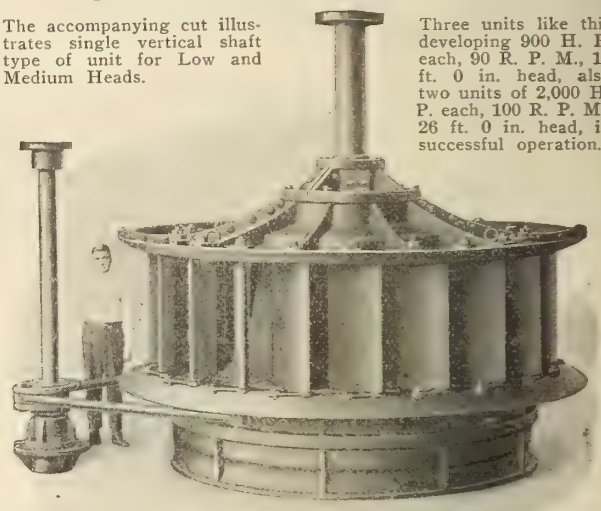
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Three units like this developing 900 H. P. each, 90 R. P. M., 15 ft. 0 in. head, also two units of 2,000 H. P. each, 100 R. P. M., 26 ft. 0 in. head, in successful operation.



Write Department "N" for Bulletin of Designs and Useful Data for Hydraulic Development.

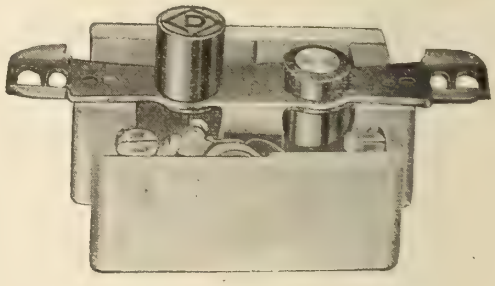
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Shallow Type—Superb Action

Single Pole
No. 200

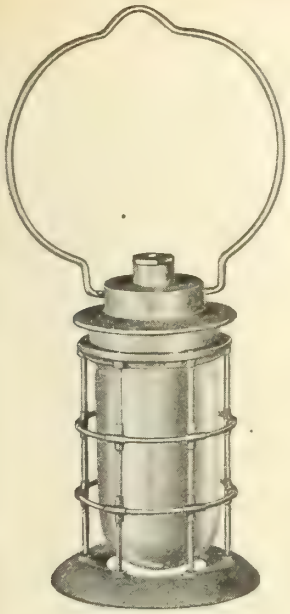
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Only One Inch Deep—
Easy to Install—
Price is Right

Manufacturers

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Catalog No. 2704

One of the many

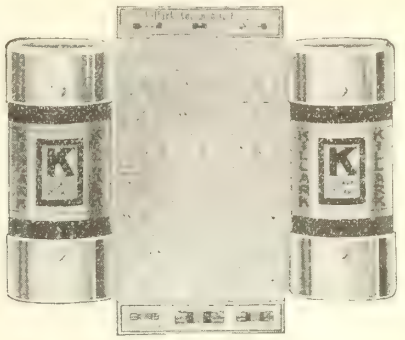
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Offer substantial profits to every dealer



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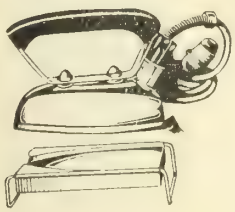
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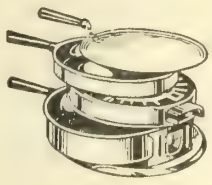
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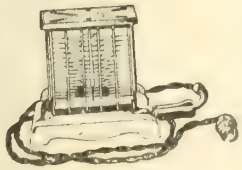
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New York Headquarters for the Canadian Electrical Trade

Here's the line you've been waiting for—made by men who have grown up with the industry.







"Now You've Hit It"—

That's a remark we frequently hear in introducing the "Premier" line of appliances. For the sterling goodness of "Premier" products needs no talk. The sturdiness, neat design, and superb finish are visible at a glance.

They are made by men who have served years in the business; men who know what you want; men who know how to build appliances with a merit that makes them easy to sell, worth the price paid, and a basis of customer-satisfaction.

And behind the "Premier" line is an organization known throughout the trade as progressive .Already strong advertising campaigns are under way. Folders and window displays of a new, striking character are ready.

All dealers who have seen "Premier" appliances are boosters. Distribution is coming fast—faster even than we anticipated. There's room for you in the "Premier" dealer organization if you get in quickly—before your territory is handed over to another live man.

PREMIER

"All That the Name Implies"

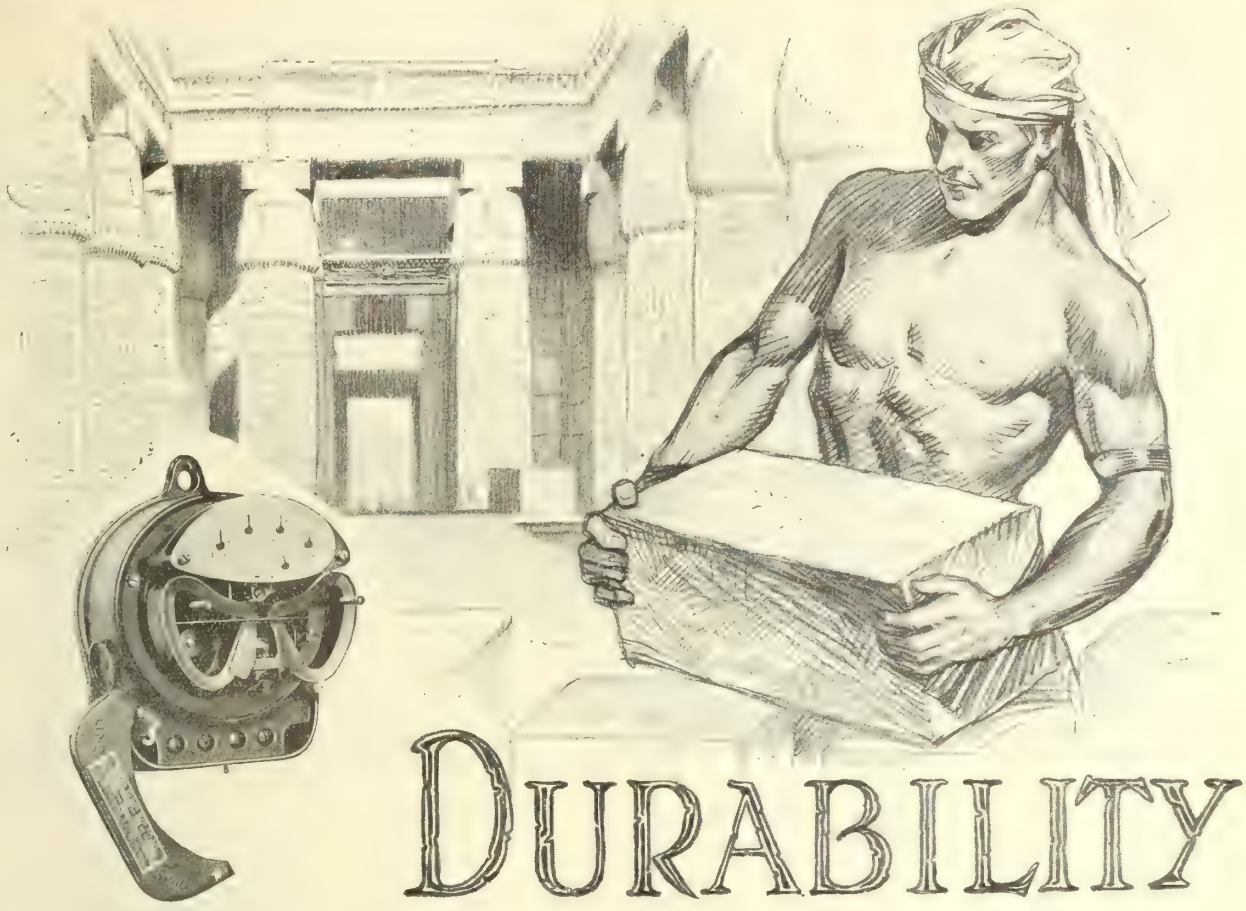
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There's profit in handling "Premier" Electrical Appliances. Write for the facts and figures to

SUPERIOR ELECTRICS, LIMITED, PEMBROKE, ONT.

Universal Cooking Appliances





DURABILITY

Type I-14 Watthour Meter

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Announcement!

For 23 years we have been engaged in the manufacture of incandescent electric lamps. Commencing in 1895 with the Old Style Carbon Lamp now obsolete, and advancing step by step through the development of tungsten vacuum type units, on up to our present achievement—a nitrogen lamp to be better known as the

"Blue Label Nitro"

No expense has been spared in carrying out the very latest scientific principles of manufacture, including equipment for generating our own nitrogen gas—a facility not possessed by any other lamp factory in Canada. Our experience and reputation are behind these lamps—they must "MAKE GOOD" and all we ask is an opportunity to prove their worth.

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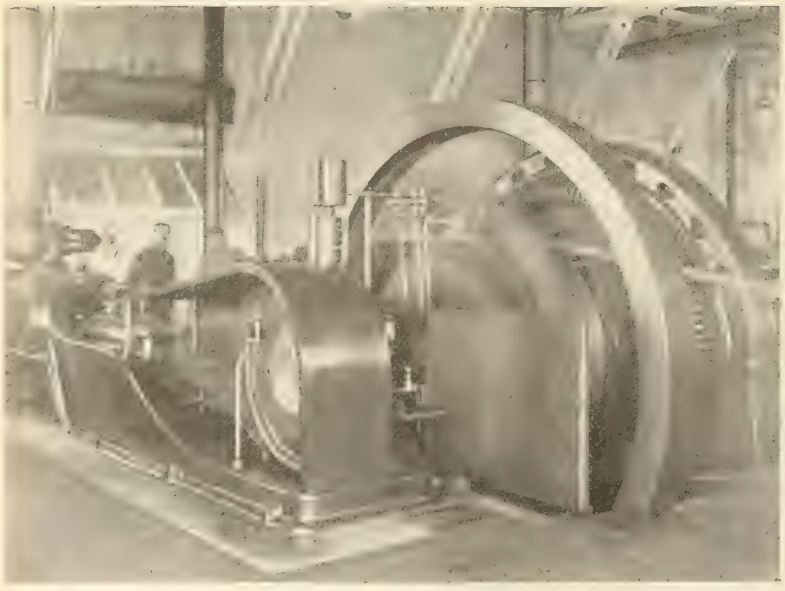
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Manager, Buffalo Sales Office.

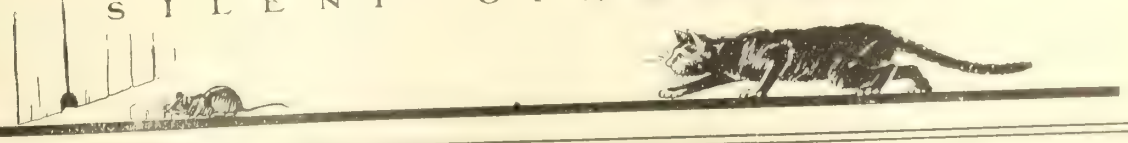
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Generation, Transmission and Application of Electricity

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Toronto Section A.I.E.E. Has Spent Active Year

It is a matter of regret that there were no representatives of the manufacturers present to discuss the paper by Mr. Ackerman, of the Toronto Power Company, on "High Tension Insulators," which was read before the Toronto section, A.I.E.E., on Friday, April 19. The paper, which dealt with the operating aspect, was a most thorough one, and showed not only the improvements which the last decade has brought about in the line insulator, but also the opportunity for further development to produce an insulator which should prove more resistant to power arc discharges, as well as to punctures. The modern pin-type insulator shows a somewhat more compact design than that of ten years ago, being more free from deep and intricate cavities which were of little use in preventing leakage and none at all in reducing the risk of flash-over. Mr. Ackerman commented upon the desirability of drawing the arc away from the insulator, and pointed out that arcing horns and the well-known Nicholson ring were not thoroughly effective in this respect, as they rather tended to localize the flashover until it was ruptured, or until the insulator failed. A new type of arcing horn was described, which took the form of a spiral around the wire with a radius equal to the depth from the wire to the foot of the insulator pin. It was shown by a remarkable series of photographs that this would instantly draw the arc well away from the insulator towards the tip of the horn, and that until the short was cleared no damage could happen to the insulator.

In the discussion Mr. H. C. Don Carlos did not agree with the author in extending the field of pin type insulators into the region above 60,000 volts; rather would he expect to see suspension insulators adopted for 44,000 and all higher tensions. In conversation with the engineers of the Mississippi River Power Company, he had learned that practically all the failures on their 110,000-volt lines had been due to cracks in the porcelain, and he believed that this experience was not unusual. Mr. Davison pointed out that among other advantages the suspension insulator permitted of easier testing of the insulators on location, and, furthermore, that it lent itself to standardization. If manufacturers were to be asked for pin type insulators of 50,000, 60,000, 70,000 volts and higher pressures, the cost of insulators would naturally be higher and the deliveries less satisfactory than where suspension strings of standard elements were specified for these voltages. A number of other most interesting points were raised in the discussion, which tended to demonstrate that there is considerable diversity of personal opinion among transmission engineers regarding the insulator problem, and that the same problem is being effectively solved in more than one way in different installations.

The Toronto Section has just achieved a new record among the thirty-three sections of the American Institute of Electrical Engineers. Fifty-two new applications for membership have been filed during the campaign which ended on April 30 last; this corresponds to an increase of about 25 per cent. and, we understand, is ahead of that of any other section, and testifies to the appreciation in which membership in the institute is held. Non-members often do not realize that a distinct advantage is associated with membership in the Institute. The opportunity given for associating with members of the same profession in different grades is of inestimable value. Great credit is due to Mr. A. B. Cooper and his membership committee for the results obtained. We are advised that the actual number (as distinct from the percentage) of members signed up in Toronto was surpassed only by Philadelphia and Pittsburgh.

The result of the elections for officers of the section for the next year was declared at the meeting of Friday, April 19, as follows:

Chairman—Arthur H. Hull (Hydro-Electric Power Commission).

Secretary—Ernest V. Pannell (British Aluminium Company, Ltd.)

Executive—Ashton B. Cooper (Canadian General Electric Company, Ltd.), Frank R. Ewart (Ewart & Jacob), William G. Gordon (Malm, Gordon & Co.), W. Percy Dobson (Hydro-Electric Power Commission), William Volkmann (Toronto Power Company), Herbert B. Dwight (Can. Westinghouse Company, Ltd.), Gordon R. Langley (Can. General Electric Company, Ltd.) The last-mentioned two are out-of-town members.

First Convention of Municipal Electrical Association

The Association of Municipal Electrical Engineers, plans to hold its first meeting on June 14th and 15th next, at Niagara Falls, Ont. An interesting programme is being prepared, consisting of papers on subjects of importance to the delegates, and a tour of inspection of the Chippewa Creek development. Although this organization has been formed for the benefit of the officials of municipally owned electrical utilities in Ontario, yet it is felt that there will be much in the proceedings that will be of interest to men in the electrical trades who are doing business directly with those utilities. The Association, therefore extends an invitation to electrical manufacturers, contractors, and dealers to have representatives attend that meeting, and assures a hearty welcome to all coming in such capacity.

Montreal Electric Luncheon Club

"The Value of Air Brakes" was discussed by Mr. W. J. Hatch, of the C.P.R., at the Montreal electrical luncheon on April 24. Considering the investment, said Mr. Hatch, there was no part of the railway equipment that would give greater material returns when properly installed, maintained, and operated than the brake. Electric locomotives were no longer to be regarded as experiments, and there was reason for believing that a train would be accelerated up to a speed of 60 miles per hour in one minute. This meant that the brake was going to be more important in the future than in the past. The ability to accelerate, or even to run at high speeds, must be measured by the ability to stop.

This feature was little appreciated. As an example, railway men were often called upon at investigations to answer such a question as this: "In what distance should the train have stopped?" It seemed a simple question for an air-brake man to answer, but to do so it would be necessary to know the light weights and loads of the vehicles composing the train; the percentage of brake power used with engine and cars; if brake shoes were applied to all wheels, including engine truck and trailer wheels; type of brake; pressure carried; whether the train was accelerating or decelerating; on curve or straight track; on ascending or descending grades, or level; the condition of the rail; if brakes were applied in service or emergency or ordinary service then emergency; the piston travel on each vehicle; the losses due to friction of parts; brake beam release springs; wind resistance; quality and thickness of brake shoes; the method of hanging them, and other factors.

One heard very little about brakes in the papers, nothing like one did about electricity, for instance, yet it had been much more of a factor in railroad development up to the present time than electricity. A good brake must be automatic, simple, durable, always ready, responsive, and flexible, and, in addition, it was imperative that in a case of emergency the maximum brake power be obtained with the time element reduced to a minimum, so that a stop could be made in the shortest distance and time possible. For service or regular stops all these elements should be extended so that the trains could be handled smoothly and acurate stops made without inconvenience to passengers or damage to lading, keeping in mind at all times that in time of danger to stop was the chief consdieration. The braking power on hand must be available not only for one application but for any number of them. Not only must the brake dissipate energy due to momentum when bringing a train to a stop but it must prevent the accumulation of energy when descending a grade. A train of 3,000 tons commencing the descent of a 2 per cent. grade, at a speed of ten miles per hour, would in three minutes, due to acceleration of gravity alone, be moving at a speed of 64½ miles per hour, and the kintic, or wrecking energy, stored up in the train would be 417,500 foot-tons, sufficient to raise the train to a height of 139.1 feet. So it was necessary for the brakes to be able to dissipate in three minutes 417,500 foot-tons, if the speed at the end of this time was not to be higher than at the beginning, and still have a reserve to make any desired stop.

There was a prevailing idea that the friction between the brake shoes and the wheels was what stopped a moving train. No doubt this was the primary cause, but the real factor was the friction between the wheel and rail. For instance, if the rails were made of ice, it was obvious that the stop would be lengthened very much; the friction between the brake shoes and wheels would be sufficient to lock and slide the wheels. Therefore, brakes had to be designed in such a manner as to prevent wheel sliding; it was also obvious that the rail condition was a large factor in relation to the distance required to stop a train.

Unfortunately for air-brake men, co-efficient of friction (which was the relation between the retarding force and the pressure on the brake shoe) was one of the most elusive and variable things in mechanics, and increased with the decrease of speed and to a surprising extent. For example, a train running at 60 miles an hour would require approximately at least four times the distance to stop in than if the train were only running 40 miles an hour.

Mr. Hatch then dealt with the financial side of the subject, pointing out that the daily charge for the brake equipment per car was 1.095 cents, which was 44/100 of 1 per cent. of the daily revenue (2.50) which the brake made possible.

McGill Examination Results

The results of examinations in the faculties of Arts and Applied Science at McGill University have been made public. In Applied Science, Mr. Emil Edwin Weibel, who graduated as a mechanical engineer, won the British Association Medal, and the Crosby Steam Gauge and Valve Company's prize for summer essay, while he took honours in hydraulics and laboratory and hydraulic machines, machine design, and thermodynamics.

Passed for B.Sc. Degree

Civil Engineering—Henri B. Pelletier, Montreal. Unranked—Arthur A. Brown, Ottawa.

Electrical Engineering—In order of merit—Joseph M. Conroy, Britannia Bay, Ont.; Joseph A. Dionne, Montreal; William McL. Moore, Sydney, N.S.; William R. Way, Montreal; Daniel McL. Sutherland, New Glasgow, N.S.; Leo J. Jordan, Lindsay, Ont.; Thomas J. Fox, New York; Frederick L. Cann, Peterborough, Ont. Unranked—Ira W. Beverly, Rossland, B.C.; William H. Gorrie, Kenora, Ont.; James F. Patterson, Montreal; Roy A. Weagent, New York.

Mechanical Engineering—In order of merit—Emil E. Weibel, Montreal; Charles S. Parke, Hamilton; Hugh A. Crombie, Toronto.

Mining Engineering—In order of merit—Harold M. Roscoe, Centreville, N.S.; Edward A. Livingstone, Washington D.C. Unranked—William Weir, Notre Dame de Grace, P.Q.

Chemical Engineering—In order of merit—Herman R. Dorken, Westmount, P.Q.; Clifford Greaves, Barbados, B.W.I. Unranked—George G. Ulmer, Jr., Montreal.

Small Hydro Plant for College

A hydro-electric plant for the College de Montfort, P.Q., is to be rebuilt, the contract having been let to Messrs. Arsenault & Plamondon, Limited, Montreal. A concrete dam, 10 ft. x 12 ft., is to be constructed at the entrance to a small lake, a wood stave pipe line, 3 ft. in diameter, inside measurement, conveying the water to a power house, of brick and concrete, 25 ft. x 15 ft. The water wheel will be of 150 h.p., and will be manufactured by the William Hamilton Company, Limited, Peterborough, Ont. The power will be used for lighting the college, sawing wood, and for laundry purposes. The water is to be pumped for domestic use and for fire fighting purposes. Arthur Surveyer & Co., Montreal, are the consulting engineers, the electrical work—a portion of which is already done—being carried out by E. Lionais, Montreal.

The Kincaid Waterwheel and Power Company, Ltd., has been incorporated; head office, Vancouver, B.C.; capital stock, $50,000. The company is empowered to carry on a general electrical engineering and contracting business, including the manufacture and installation of waterwheels and all kinds of electrical power and lighting equipment.

Electric Heating—Some Practical Experience

Installed Capacity of 1.2 to 1.8 Watts per Cubic Foot of Air Space Gives Normal Living Temperature

By Mr. E. R. Shirley*

Electric heat is simply electricity displaying its energy in the form of heat. We might call it the modern scientific method of heating.

Some of the particular advantages which are hard to appreciate, except by using the same exclusively, are enumerated below:

1. Great efficiency, the electric heater being nearly 100 per cent. efficient.
2. Entire absence of smoke, dust, and fumes.
3. Elimination of storage and handling of fuel.
4. Lessening of fire hazard.
5. No vital oxygen is consumed from the air as in the case of open flame heaters.
6. Great flexibility in temperature control, it being readily adapted to automatic control schemes so that any predetermined temperature may be constantly maintained.
7. It is extremely portable, heaters being readily located wherever required within very wide limits.
8. Heat is instantly available at the turn of a switch, scarcely any care or attention being required, the heat ceasing immediately the switch is opened.

My first serious attempt at electric heating was in Northern Ontario, when with the British Canadian Power Company, at Cobalt. A number of the houses for our staffs and also our office and several other buildings were heated electrically. We made no particular attempts at making tests or taking records of the amount of power required, simply installing as much heat as we were sure would suffice and then using whatever percentage of that heat that we found was required. I might say that we averaged about three watts per cubic foot of heated air space installed capacity, but seldom used more than from 30 to 50 per cent. of this amount.

The heaters were individual units, made in our own machine shop, and consisted of ¾ in. spiral coils of resistance wire for some and galvanized iron wire for others, the wire being usually about 14 B. & S. gauge. These were strung on 1 in porcelain knobs, fastened to an iron framework, and the whole heater encased in perforated sheet metal.

While I was in this district we designed heaters for a number of the buildings at the Wettlaufer Mine, in South Lorraine, where the famous Keely Mine is located. These were detached buildings, previously heated by steam from the main steam plant. The boilers were fired by coal, which had to be brought up Lake Temiskaming by boat to Silver Centre, and from that point hauled about eight miles, over a rough road. The laid-down cost of the coal would be in the neighborhood of $12 per ton. We based our calculations on an efficiency of about 10 per cent. for the detached steam heating and 100 per cent. for the electric heaters, and found it worked out quite satisfactory. This was not cheap heating by any means, as the Wettlaufer people paid us a price for the power used which amounted to about 1 cent per kw. hr. They, however, were quite willing to pay the price for the convenience and safety involved.

Later on, when connected with the Canadian Exploration Company, I did considerable further experimenting with electric heating. We had been using steam heat and were distributing it among a number of detached buildings. Coal was costing from $12 to $15 per ton, laid down. We had a considerable available surplus of electric power at 550 v., which was costing us $16 per h.p. per year, or about ¼ cent per kw. hr. I designed a heater which took 7 amperes at 550 v., or 3.85 kw. This was found to be a very satisfactory size, so we used it exclusively. When a large heater was required we combined two in the form of a double circuit unit.

In mining communities nothing, as a rule, is installed which is required to last longer than the lfe of the mine, which, ordinarily, is but a few years. For this reason our heaters were made as cheap as possible. The frames were of 1 in. x 1/8 in. band iron. The coils were of ordinary stovepipe wire, wound in spirals on a 5/8 in. mandril. The spirals were strung on 1 in. porcelain knobs. The heaters completed cost about $3 each to make. The iron wire does not last as long as the better grades of resistance wire, but it is cheap and easily replaced when required.

In my own house, which was a one-storey frame bungalow, 32 ft. x 24 ft., with 10 ft. ceilings, which, allowing for the walls, had a cubical contents of 7,230 cubic feet, I had very good results. This was boarded and then covered with builders' paper and clapboards. Inside was finished with beaverboard, placed directly on the studding. The floors were of hardwood. There was no foundation, the house being simply placed on posts, the basement being boarded up with one layer of inch boards and covered with heavy tarred felt, fastened with 3 in. battens. The windows were standard construction on pulley weights and fitted with double windows for winter. The doors also were fitted with storm-doors. The absence of a foundation made it necessary to run a 2 kw. heater in the cellar to keep it above freezing temperature. I had about 13 kw. power installed, which was a total of 1.8 watts per cubic foot.

This total amount was never turned on more than two or three times during the time I occupied the house. The maximum in cold weather was usually 8.9 kw., or 1.23 watts per cubic foot. This amount, in addition to heating the house to 70 degrees F., did all my cooking. Outside temperatures at times went as low as 43 degrees below zero. At one period, in February, 1914, the minimum temperature for a continuous perod of three weeks ranged from 18 degrees below zero to 43 degrees below zero. During this severe weather I had no difficulty whatever in keeping my house temperature at 70 degrees F., and using only 1.23 watts per cubic foot as a maximum.

The average for this period did not run over 90 per cent. of this, approximately 1.1 watt per cubic foot, making the cost of heating the house and doing the cooking in the severe weather about 48c per day at the price we were paying for power, viz., ¼c per kw. h. At the present rate in Peterboro, of 1¼c per kw. hr., this would have cost $2.40 per day, or about $72 per month, less discount.

The other installations at this same plant ran about the same in capacity. One building had as low as 1.2 watts per cubic foot installed, and the occupants claimed it was comfortably heated.

At the Laurentian Power Company's plant, near Quebec City, I had an opportunity of making some very exact tests on a complete electric heating plant which we had installed in a six-house terrace for our staff. This terrace was of 46,688 cubic feet capacity, being a two and a half storey frame structure, placed on a solid concrete foundation. The walls were boarded with 1 in. boards and covered with builders'

*Read before the Peterboro Engineers' Club.

paper and clapboards. The interior was lath and plaster. The windows were standard construction, on pulley weights. The doors were also standard. There were double windows for winter, but we did not use them, as e found they were hardly necessary—in fact, there were usually one or more windows in each house opened probably a foot. There were no storm doors or porches. The basement was quite open at the top of the concrete foundation, due to poor consruction, so that the cellar temperatures were seldom more than a few degrees above freezing.

The temperatures were taken in the house situated at the north end, on a thermometer placed close to the north wall. Outside temperatures were standard government readings, taken especially for our plant. Power readings were taken both day and night, on a meter installed for that particular purpose.

Each house was arranged with ducts in the walls and registers in each room as for ordinary hot-air heating. The heating plant consisted of two iron boxes in the basement, near the centre of the terrace. These were lined with ½ in. asbestos, and contained the heating elements, which were advance resistance wire strung on porcelain knobs on iron frames. Each box contained 18 frames, so arranged that they could be connected to a 550 v. 3-phase service, with switches for connecting the set in closed or open delta, two sections in series across one phase or one set singly across one phase. This gave a large degree of heat variation. Each heater was 50 h.p. capacity, or a total of 100 h.p. for six houses. One end of these boxes was connected with a long duct, which in turn connected with the heating ducts of the various houses; at the other end of each box was a motor-driven fan, capable of delivering 2,000 cubic feet of free air per minute. These fans forced the air through the heaters and into the houses.

A continuous test run on the heaters from February 17 until March 31, 1917, gave an average internal temperature for the houses of 70.3 degrees F. The average minimum temperature of the outside air, to the end of February, was 8.67 degrees below zero, giving a heating range of approximately 79 degrees F. The average watts per cubic feet of heated air for this period was 1.27. During March the average minimum temperature outside was 10.3 deg. F. above zero, giving a heating range of 60 degrees F., the average watts per cubic feet of heated area being .93. The maximum amount of power used at any one period was 1.63 watts per cubic feet of heated area at a time when the minimum outside temperature was 28 degrees below zero and the maximum outside temperature just zero. The internal temperature during this period was just 70 degrees F., giving a heating range of 98 degrees F.

In considering these figures it should be remembered that the results obtained both in Northern Ontario and Quebec were in places where the climate is exceedingly severe.

Our results at the plant of the Laurentian Power Company and also in Northern Ontario were so good that we found it difficult to get them generally accepted. This point of view is readily understood when we consider the fact that the formulae generally used for computing the necessary heating will, in nearly every case, give the amount of power required at probably double the quantities I have found to be actually necessary. The formulae I refer to embrace a large number of constants, which vary according to the type of house or building to be heated, the amount of exposed wall surface, the number and character of windows and doors, the number of changes of air per hour, and the nature of the heating, i.e., whether it is constant or more or less intermittent. In considering all these facts, it is easy to vary the formulae constants within such limits as to entirely alter the heating problem. For this reason when using a formulae for making any such calculations the problem in hand must be very carefully studied.

In view of the results I have obtained in different parts of the country, and under very severe conditions, I have no hesitation in saying that equally good results can be obtained in Peterboro by using a maximum installation not exceeding 1.25 watts per cubic foot of heated air space. The average power required would probably not run more than one watt per cubic foot, even in the severest weather. I make this assertion from the fact that the houses in a city are, as a rule, better constructed than in the outlying districts where I conducted my experiments. Furthermore, the climatic conditions are not nearly so severe, neither are you exposed to the elements so directly in a closely-built up community.

An average house in Peterboro would probably be around 8,000 cubic feet in capacity of air to be heated. Supposing it is desirable to heat it to 70 degrees F. throughout, about 10 kw. would probably be sufficient to take care of the average conditions. At the present rates of 1¼c per kw. hour this would cost 12½c per hour, or $3 per day, less the discount. As it is hardly desirable, in most cases, to heat the entire house to 70 degrees, this figure might be reduced to 60 per cent., or say $1.80 per day, less the discount. It now seems possible that the Hydro rates may be cut to 5/8c per kw. hour where the power consumption runs up to 60 kw. hours or over. This would reduce our figures to 90c per day. Taking off the 10 per cent. cash discount makes this 80c per day. For an average 30-day month this would amount to about $24; or, supposing you heat for approximately six months in each year, it would be roughly $144 per year, which figure would be not unreasonable, and would be equivalent to from 12 to 14 tons of coal at the present price.

Individual heaters would probably be the cheapest installation. A circuit can be run in the basement and brought up through the floors wherever it is found most expedient to install heaters. One or two circuits would take care of the upstairs heating. In fact, small heaters up to 600 watts capacity may be used on the ordinary lighting circuits where the wiring is strictly up to date.

Individual heaters can be purchased from most any electrical dealer, in sizes ranging up to 5,000 watts capacity, and at prices up to $35 and $40 each. For instance, a 1,200-watt heater sells at about $16, and a 2,400-watt size at about $22. A 1,200-watt heater would cost to run at present rates 1½c per hour, less discount, and the 2,400-watt size 3c per hour, less discount. It is now possible to obtain very nice electric logs in capacities up to 3,000 watts and at prices up to $28. A 3,000-watt log would cost to run at present prices 3¾c per hour, less the discount, which is much cheaper than the equivalent gas log.

Another form of heating which I might touch on here is the electric circulation water heater for a range boiler, and which could be easily attached to a hot water system. I have used a large number of these and find they give excellent service and are very economical. The ordinary heater can now be obtained in capacities of 600, 1,000, 2,000, and 3,000 watts each. The 600-watt heater is for continuous operation on a 30-gallon tank and the larger heaters for intermittent operation. The 3,000 watt heater heats 25 gallons of water from 50 degrees to 140 degrees F. in one hour, and is practically equivalent to the ordinary gas heater consuming 50 feet per hour. In this case the gas heater would cost 7c for an hour's run, at the present rate of $1.40 per thousand cubic feet, while the electric heater would cost 3¾c, less the discount, or practically half the price of the gas. Two or more high capacity circulation water heaters attached to a hot water system should be sufficient to heat a house. The circulation heater has been developed even further in the induction type, which may be obtained up to 100 kw. capacity, and have even now been used in certain installations for developing steam in a steam boiler.

The next problem that presents itself is, Can we obtain the necessary power? Peterboro has a population of about

23,000; assuming four or five persons to a house, there would be approximately 5,000 houses. Providing 20 per cent. of the houses would desire electric heating and that an average of 8 kw. per house was installed, which would be a fair estimate, we would require 8,000 kw., or over 10,000 h.p. A fact to be considered here, also, is that the greater part of this power would be used during the winter months only, and some other use would have to be found for it in the summer, in order to make the installation profitable. Of course, we might ease the fuel situation considerably by utilizing any available off-peak load during part of the 24 hours and using coal or wood during the time the peak load is on. This would need careful investigation, and would have to be handled by the Hydro representatives.

Another point I have not touched upon is the increased capacity required of the secondary distribution system should such a heating load be taken on. This also would have to be referred to the above representatives.

Shawinigan Falls, Que., Wonderful Power and Industrial Centre

"Shawinigan Falls, its industries, electro-chemical activities and transmission of power," was the subject of a talk by Mr. H. E. Randall, of the Shawinigan Water & Power Company, at the Montreal Electrical Luncheon, on March 13. The talk was illustrated by a large number of pictures, showing the expansion of Shawinigan Falls, from a place with practically no population, to a town of over 12,000 inhabitants; the large number of buildings devoted to new industries, many of them now engaged on war work; and also interior and exterior views of the power plants there and of the Laurentide Power Company at Grand'Mere.

The town of Shawinigan Falls, said Mr. Randall, was predestined to become important, due to the falls on the St. Maurice River, which are 150 feet high there, and due to the fact that this spot furnished what at that time was probably the cheapest hydro-electric development of the world. After much hardship and ups and downs over a period of ten years, the Shawinigan Water & Power Company finally got on to a strong financial basis and was delivering some 50,000 h.p., used for aluminum, paper, and transmitted for lighting and power to the various parts of the province. From that date the general use of power in the province increased tremendously. The power houses which produce power, which has made all these things possible, contain to-day an installed capacity of 196,000 h.p. The city is the result of the workmen and management drawn there to operate the large factories which have located there. The Northern Aluminum Company, the Belgo Canadian Pulp & Paper Company, the Canada Carbide Company, the Canadian Electro Products, the Canadian Electrode Company, the Canadian Electro Metals Company, Fraser, Brace & Company's steel plant, and the latest addition to the Shawinigan industries is the Canadian Aloxide Company (the Canadian name for the Carborundum Company), who will employ 24,000 h.p. in the works which are now started, nearly twice the amount of power used by the Carborundum Company at Niagara Falls. Some of the carbons for electric furnaces manufactured by the Canadian Electrode Company were 1½ x 7 x 8, and carried a current of 40,000 amp. La Loutre dam, a picture of which was shown, will nearly double the capacity of the Shawinigan Company, and will impound water representing a million kw.h.

The transmission system of the Shawinigan Company amounts to about 1,700 miles of line, reaching the more important places of the Province of Quebec. Practically all the asbestos of the world is mined with Shawinigan power; by far the larger portion of the paper made in the Province of Quebec is made with Shawinigan power; by far the larger portion of electric light used in the Province of Quebec is supplied by Shawinigan power—so that this transmitted power has come to have an important bearing on the life of the province. This has been particularly true since the war. In other times the munitions plants would have had to wait for the motive power to operate, whereas the power companies and electrical apparatus companies were ready and waiting to supply the motors and the power to turn these plants as quickly as they could be assembled. This speed and the resultant economy of operation have been important factors in this war. Moreover, electro-chemical processes at Shawinigan, some new, others old, have every one of them supplied important munitions demands and have been a great factor for that reason.

They heard a great deal about the Ontario hydro-electric system, but the Shawinigan Company had three power developments, any one of which would handle the entire load of the Ontario system in 1916. Continuing, Mr. Randall remarked: It is open to serious doubt whether the future commercial loads, as we know them, will be handled by Hydro-electric plants or by steam plants. The present efficiency of conversion from water to electricity is well up to 90 per cent.; the present efficiency of conversion from heat in coal to electric power is around 20 per cent. In the one case you have practically no possibilities; in the other case you have tremendous possibilities of betterment.

At the present time, for ordinary commercial city loads a well designed steam plant having large units, properly located with respect to water, etc., can supply in most parts of North America now settled, electric power for distribution in city streets at a price which favorably compares with Hydro-electric transmitted power. This is shown by the remarkable success of the 100,000 h.p. steam plant located at Buffalo. What then would result if somebody should produce —as no doubt somebody will produce—a metal capable of withstanding temperatures of a red heat at high pressure? Immediately the efficiency of conversion from heat to electricity would jump, and all our elaborate transmission systems would be open to obsolescense, due to changing methods, because they cannot be materially improved.

Different Forms of Power Transmission

With regard to transmission, electricians think only of electricity as a means of transmitting power, but what is a train of coal but a means of transmitting power—latent power, it is true, but it is transmission nevertheless. What is the conduction of oil through pipe lines but the transmission of power? And it is interesting to note that these two methods of transmission far outstrip the transmission of power by electricity in distance, there being pipe lines in the United States nearly 2,000 miles long. So then, since there are several kinds of transmission power, the electrically transmitted water power has to compete at the receiving end with the power transmitted by the railway line or otherwise, and in this country where steam is used for heating during a large portion of the year a still further advantage exists for other kinds of power derived from heat, but nevertheless, with cheap power at the source and with careful transmission, with low loss, which in good lines should not exceed 5 to 10 per cent., it is possible to economically compete with other transmitted power, and as a result the transmission lines grown up.

Transmission, however, has another aspect, and which will no doubt in the future become a most important aspect, that is, transmission lines will not be used so much for trans-

mission of hydraulic power to its centres of use, but rather for the tying together of all sources of power, so that the use of electricity, or of the powers of the country transmitted to your door by means of electricity, may be well nigh universal. A map showing the more important transmission lines of the United States and Canada indicates that these transmission lines have been built up almost exclusively around water powers, there being a few through Ohio, Pennsylvania and Illinois which are steam transmitting systems, but these three states show the new tendency, the linking together of large stations, feeding a vast network which brings about a uniformity and continuity of supply at a low price, so that the public utility is able to supply the public with that which it desires at the lowest possible cost, and is, therefore, successful.

I predict that the transmission lines will in the next ten or twenty years become pretty well inter-connected so that we will have not a large number of large or small separate systems, but a large inter-connected system, presumably made up of a few large organizations inter-changing their energy on some equitable basis.

We must not let our enthusiasm run away with our better judgment when it comes to hydro-electric power. To-day it is a fetish in some parts of Canada, but it is subject to many pitfalls, the most important one of which is other kinds of transmitted power, but it nevertheless has a big future, especially for those kinds of loads which we call high load factor loads, that is, those loads which will use the tremendously heavy investment in hydro-electric generating stations and transmission lines the greatest number of hours in a year. For other loads, that is, low load factor loads, other means of producing power will probably show up more advantageously than the present harnessing of hydraulic power.

Electric Heating

We are hearing to-day a great deal about electric heating. The Shawinigan Company has for several years carried out experiments in electric heating of houses, and while this data has been crudely gathered, nevertheless there is available a pretty good indication of the facts. The basic principle of electric heating is that electricity can be turned into heat and distributed through the room at 100 per cent. efficiency, whereas coal or other sources of heat can only be turned into usable heat and distributed at some fraction—say probably 50 per cent.—efficiency, but never forget that 1 kw.h. fundamentally and absolutely has only the intrinsic heat value of one-quarter of a pound of good coal, and that it only has the equivalent heat value of about one-third or one-half of a pound of coal when burned in the ordinary manner. So we cannot hope in the future for more efficient use of electricity for heating except in the distribution of the heat; that is, no electric heater will give or put into the room more heat than there is in the electricity, and almost any kind of electric heater from the standpoint of heat alone, not long life or ease of operation, is the equivalent of any other.

Most of us have been working on electric heating as an off-peak proposition, realizing that it must be done with cheap electricity to succeed. Now, an off-peak proposition can only be worked when the ruling load is bigger than the off-peak load. The data from electrical distributing companies shows that the average city house takes a maximum demand of about 400 watts on the average—say, one-half a kilowatt. Our experiments on electric heating of houses show that the average house requires about 20 kw. of maximum demand, or of almost continuous demand in cold weather, to keep it warm, and this with properly designed heaters. You can see, therefore, that electrical heating can never be an off-peak load unless some other load can be developed which would be off-peak to it, and sold at a very low price.

We also find that it requires some 30,000 to 40,000 kw.h. a year for heating the average house, and this in the winter time, when our hydraulic powers are at their lowest. Let us see what this means in horse power. To be ultra-conservative, let us say that instead of 20-kw. the average house would only take 20 h.p. Now the city of Montreal has roughly 125,000 houses—say 100,000. Now, 100,000 houses at 20 h.p. per house is only 2,000,000 h.p., a figure which is greater than the entire hydro-electric power of Canada to-day, and in fact, there is not enough hydro-electric power developed in the entire continent of North America to-day to heat the little province of Quebec.

But now let us examine what this would cost. With some knowledge I could say that on this tremendous scale electricity could not be delivered to your door for less than $20 per h.p. for the season's service; that is, the average householder would have to pay $400 a year, or the city of Montreal householders would have to pay $40,000,000 a year for heating their houses, whereas actually they pay, at $10 coal, not over $7,000,000; that is, there is quite a margin between electrical heating of the houses of Montreal and heating them with coal, but you say—"What would we do if we had no coal?" The answer is, there is always commerce, and while there is commerce there will be coal—at least in our day and generation—and if instead of using this tremendous amount of power for heating purposes, which we electricians call low grade purposes, let us use it for high grade mechanical, electro-chemical and electro furnace processes, which would make this country the most important country in the world in this regard, and would probably add tremendously to our wealth.

The city of Shawinigan Falls to-day uses 100,000 h.p. and exports from Canada yearly products amounting to $20,000,000; that is, holding the same proportion, the 2,000,000 h.p. required to heat the city of Montreal would bring to this country as a favorable trade balance twenty times $20,000,000, or $400,000,000 per year, whereas it was shown that $7,000,000 would have purchased the coal which this tremendous amount of power would have made unnecessary.

Is there any heal argument in favor of electric heating when it means the sacrifice of valuable electricity, valuable in producing new chemicals, new products, in increasing the wealth of this province seventy times the value of the electricity used as heat? After the war we are going to face debt—the interest on debt. It is only by favorable trade balance that this can be remedied. Let us, therefore, get together and boost for the big thing, not the selfish heating of our houses, but for the development of these water powers and the use of this power for industrial purposes to increase the wealth of this country.

The Canadian Bridge Company, Limited, of Walkerville, Ont., announces the appointment of Mr. John W. Seens, as sales manager, with offices in New Birks Building, in Montreal, effective May 1st, 1918. Mr. Seens was for the past seven years manager of the Structural Steel Company, Limited, of Montreal, until that company discontinued operations the latter part of last year, on account of being obliged to surrender their leased shop. During the period under Mr. Seens' regime the Structural Steel Company successfully carried out the fabrication and erection of many of Montreal's largest buildings. They also furnished a large measure of the steel work in connection with the large paper mill development in Quebec and Eastern Ontario in recent years. Mr. Joseph Labelle, formerly designing engineer of the Structural Steel Company, Limited, has been retained as sales engineer in the Montreal office of the Canadian Bridge Company, Ltd.

Possibilities of the Relief of Fuel Consumption by Increased Use of Hydro-Electric Energy

By J. M. Robertson*

The growing necessity for some comprehensive plan looking towards the more complete and efficient utilization of our resources has been apparent for many years to those whose duties make them familiar with the tremendous wastage of materials which results from the lack of coordination in the use of the various raw materials with which our country is so richly endowed. The public, generally speaking, has little real idea as to what constitutes the essential of conservation of natural resources. Simple reduction in demand, the restriction of the use of such materials, thereby restricting the output of essential industries is obviously not true conservation. The goal to be aimed at is development, present and future, and in order to secure this end we must make use of such materials as are necessary for the maintenance of our trade and commerce and the growth and development of our national life. Economic utilization of such resources, considering both present and future, would limit the use of irreplaceable materials even though they might be more cheaply and readily obtained under given conditions, and promote the use of other materials whose use conserves to a greater extent the assets of the community.

Consider Other Factors Besides Cheapness and Availability

The elements of cheapness and availability of raw materials are large factors in determining the success or failure of any industrial enterprise, and as such must be given due weight. We have been, however, and we are still, too much inclined to accept these factors as excuses for taking the material nearest at hand which is suitable for our purpose and letting the future take care of itself. A little thought and investigation devoted to the development of possible substitutes will frequently disclose methods by which an industry may utilize materials or processes the use of which does not deplete the resources of the country. The ideal conservation would provide for the maintenance of the industries of the world by the use of basic materials supplied from natural growth so that the stock of raw material which constitutes the capital of the world would not be reduced but would be handed down unimpaired from generation to generation.

Such an ideal conservation is obviously beyond reach in our present stage of development, but, although we are still using up our capital at an alarming rate, the increasing realization of the need of care and the increasing efficiency of utilization which science is placing in our hands makes the future look more hopeful than might be considered warranted by a consideration of the special and temporary restrictive measures which have been applied to industry as a whole during the past few months. From these experiences it is apparent that the most essential elements in our industrial life at present are transportation and fuel, and to a large extent transportation means fuel, since the equipment required for transportation can neither be produced nor operated in the absence of an adequate supply of fuel. It therefore follows that any modification of our past practice which will maintain our industries and at the same time reduce the consumption of fuels will be an application of true conservation principles in more than one way, as first, it will reduce the consumption of a material which once used cannot be replaced, and secondly, it will reduce the demand for transportation for such material and will thereby leave for the use of some other industry a larger supply of raw material for which for its purposes there is no substitute.

Use of Raw Coal for Power Generation Uneconomic

The use of raw coal as a basis for the generation of power through the medium of steam is fundamentally uneconomic, as too large an amount of valuable by-product is sacrificed for very little return, and the efficiency of the conversion is much too low. When it is considered that under average conditions the amount of coal required to generate a horse-power hour is of the order of five or six pounds, representing an efficiency from coal to power of only three or four per cent., which, generally speaking, must be again divided by two before the energy is applied to the work it can be readily realized that our present methods of operation leave much room for improvement. In defence of the steam plant it may be claimed that such figures represent only the practice of the smaller plants and that in the large manufacturing centres power is supplied from steam plants which operate much more efficiently. It is a very good plant which can average a kw.hr. on 1½ lbs. of coal, including all auxiliaries, so that even under the best conditions we get an efficiency only about 15 per cent. It is, of course, necessary to remember that such low efficiencies are not due to imperfections in the equipment, but rather to the limitations imposed by thermal laws, and until a method of conversion radically different from the present has been discovered such losses cannot be eliminated.

These figures, unsatisfactory as they are, tell only half of the story. In using raw coal we are throwing away in a wasteful manner material which contains many valuable by-products which add but slightly to its value as a fuel, but which when extracted have a value greater than the value of the coal itself. Many of these materials are essential elements in our industrial life for which at present there are no substitutes.

Notwithstanding this very unsatisfactory showing, the necessities of the case require that coal should be used for fuel in the absence of better means of providing readily available energy. It would seem, however, more or less elementary that the use of coal for such purposes should be restricted to cases where no substitute is available in order that when science places in our hands improved means of converting fuel into power, we shall not be in the unfortunate position of having squandered our patrimony and left ourselves without the means to take advantage of the improved processes when available.

Generate Power Before Using Steam for Heat

Climatic conditions in this country owing to the northern location impose upon us a heavy burden every winter. Heat must be maintained in our houses and shops. At this stage of progress the only generally available means of heating is by fuel—coal, oil or gas—of which the former is by far the most important. We cannot avoid the use of coal for heating our factories, but we can see to it that as soon as practicable raw coal is not used for this purpose, and that what fuel is used is for heating purposes only wherever adequate substitutes for coal generated power are available.

*Consulting Engineer, Montreal, Que. before Professional Meeting, Can. Soc. C.E.

many of our industrial establishments are operated entirely by coal simply because the controlling head likes the idea of "independence," and declines to consider the purchase of public service supply because he would then be "dependent on the power company." In places where hydro-electric service is available the power required by such establishments should be purchased and generally is purchasable at rates and under conditions more favorable than the costs of operation by coal and with much less investment for plant. In the cases of factories located where such service only is obtainable sufficient engine plant should be installed to make possible the abstraction of the maximum amount of energy from the steam before it is used for heating, the idea being to operate steam plant only to the extent of the heat requirements utilizing the steam equipment as the reducing valve and increasing or decreasing the purchased power to such an extent as may be required to offset the variation in the by-product power recovered from steam required for heating or process work.

As the average manufacturing establishment in most parts of Canada requires more steam for heat than for power during the winter months and almost no steam during the summer months, and as the demand for electric energy for lighting purposes is much greater during the winter, such an arrangement works to the advantage of both company and consumer as the combination makes possible the almost ideal utilization of the energy in the fuel during the winter and the capacity on the power system thus released becomes available to take care of the increased load which must be carried electrically. The diversity thus introduced into the power demand makes possible the fixing of a power rate which is attractive to the consumer, and, at the same time, remunerative to the power company.

In some plants considerable ingenuity is displayed in so combining equipment for utilizing steam, electricity and compressed air or refrigeration with outside service so that no fuel whatever is burned, except for supplying heat, and every possible unit of energy is abstracted from the steam before it is utilized as heat. Variation in the demand for air and electricity is compensated for by use of machinery driven by two sources of power involving very interesting cross conversion of energy.

The experience of those who have plants operating under these conditions is quite satisfactory as they have secured the convenience of freedom from unnecessary heat and dirt during the summer, the advantage of a standby plant as protection against shut down—extremely low cost of power during the winter and a satisfactory power service available at all times when required.

The fact that such economies are usually realized in plants of considerable size is due principally to the fact that the large plants are directed by executives of broad views who realize that elimination of waste is desirable even though in a given case it may not result in a net saving of money.

Instances have arisen this year in which factories which operate by steam power in winter and purchase hydro-electric power during the summer months have anticipated the date for the commencement of this purchased service with the consent of the power company, and are reducing their coal consumption as weather permits, to the minimum absolutely necessary for heat, and are paying to the power company for service to make up the deficiency in power recovery the net amount they would have paid for additional coal. The power company having power available is satisfied to accept this amount for temporary service from month to month without further obligation on the part of either party. Such co-operation shows evidence of broad-mindedness on the part of all concerned and leads us to hope that further progress in co-operation would develop many other instances in which very real savings could be made to the advantage of the country as a whole.

An indication of the extent to which an enlightened policy under favorable conditions can carry the substitution of hydro-electric service for steam in an industrial community is given by a comparison of the figures representing the consumption of electrical energy in the more important industrial centres in America. For the year 1916 the figures in kw. hours per head of population were as follows:—

New York, 225; Philadelphia, 250; Boston, 350; Cleveland, 400; Minneapolis, 450; Pittsburg, 500; Buffalo, 586; Toronto, 700; Montreal, 783. The figures for 1917 are not yet available, but it is probable that the figures for both Toronto and Montreal would show an increase of about 10 per cent. Montreal would thus be about 800, while the whole province of Quebec was about 700.

The total power utilized in the Montreal district is about 200,000 h.p., of which about 165,000 is supplied from hydro-electric sources and the balance by steam. If the city pumping plant and the plant of the Tramways Company are excluded, the total steam capacity now in regular operation in this territory would be about 10,000-12,000 h.p., or about 5 or 6 per cent. of the total power utilized. Even this small part of the demand would be reduced materially were it not for the fact that most of these plants are of a kind which produce large quantities of combustible waste which must be disposed of by burning or are plants in which there is relatively large demand for high temperature steam for process work and a relatively small demand for power.

When it is considered that the amount of coal required to replace the electrical energy supplied by these hydro-electric plants would be of the order of 1,750,000 tons per year it is clear that while there still remains much to do a very considerable amount has been done.

It should be borne in mind that this is no isolated instance, what has been done here is being done to a greater or less extent in many other centres as is clear from the large and increasing load carried by the Hydro-electric System in Ontario. Toronto's use of current is almost equal to that of Montreal, and both of them are quite remarkable for very complete utilization of purchased power. Co-operation between the consumer and the company with fair rates and conditions for service rendered, and a reasonable willingness on the part of the consumer to adapt himself and his plant to new conditions, even when such adaptation may perhaps entail the sacrifice of a little of his apparent independence, will assist our power companies in improving the already high character of the services they are now rendering by reducing to a minimum the utilization of irreplacable materials and extending and broadening the use of power from inexhaustible natural sources.

The development and utilization of our water power reserves is a measure of our economic advance in the scale of civilization, and the formulating of a broad and liberal policy which will ensure the keeping of such development in advance of the requirements of our industries is something which should engage the attention of our government and our industrial leaders.

It is surely not too much to hope that in a country so richly endowed with natural power sites, distributed almost ideally from an economic standpoint, the time will come when practically all of the power required for our industrial life will be supplied from such sources, and we will be free from the reproach that because it is easy and obvious we cheerfully squander our patrimony while we neglect to develop the natural heritage with which a wise Providence has blessed us.

The Dealer and Contractor

Toronto Electrical Contractors Doing Their Share in Co-ordinating the Electrical Interests

The Toronto Electrical Contractors' Association varied the proceedings at their regular monthly dinner and meeting on May 2, by inviting representatives of the central station, manufacturing and jobbing interests to be present. The invitation had been generally accepted and the attendance was unusually large. This is undoubtedly a move in the right direction—the Goodwin direction—which means a co-ordination of all the various electrical interests working, in harmony for the good of the industry—and, indirectly but surely, the good of the individual.

The chief interest and discussion centred around the agreement which the Executive of the association had just concluded with the Union. The Executive have been working hard to reach a more cordial understanding with the workmen, and there is good evidence in the agreement that the men are gradually coming to realize that antagonism to the contractors' association is a mistake. The association stands for better work, better prices, better conditions. They are working hard to remedy certain trade evils which, when removed, will benefit the workmen quite as much as the contractor. For that reason there should be only the closest co-operation between the Union and the association. The agreement as accepted by both parties is printed on the following page.

A request had been received from the Electrical Section of the Board of Trade that the Toronto Electrical Contractors' Association name a representative on the Rules and Regulations Committee of the Hydro-electric Power Commission of Ontario. Mr. Geo. J. Beattie was elected to represent the association.

The next meeting of the association will be held on June 6. This will likely be the last meeting of the season and a full attendance of contractors is expected.

The election of officers for the coming year, which was held at the May 2 meeting, resulted as follows: K. A. MacIntyre, president; Harry Hicks, vice-president; E. F. W. Salisbury, secretary; J. Everard Myers, treasurer; Executive Committee: E. A. Drury, Harry Rooks, R. A. L. Gray.

Rates Are Difficult to Understand

A correspondent, a central station man, who has operated on a flat rate of charge ever since his plant was put in operation some thirty years ago, and who finds that this method is not satisfactory under present-day conditions, writes us as follows:

"I have before me the Electrical News of recent date in which you have gone into an analysis of the new rates made by the Hydro and the T. E. L. Company, but do not understand what is meant when you speak about commercial lighting by saying: 'First 30 hours' monthly use of demand, 5 cents; next 70 hours' monthly use of demand, 3 cents; balance monthly consumption, 1 cent.'

"For example, take a store in this town open two nights a week. How is the number of hours burned to be computed? Is it estimated or measured with some kind of a clock? Then, say, this store has been lighted 100 hours. Does this mean that in the first 30 hours there is to be so many kilowatt hours allotted at the first rate and in the next 70 hours likewise?"

The answer to this question lies in the meaning put on the word "demand"—that is, the maximum demand, or, in other words, installed capacity. When we speak of the first 30 hours' use of maximum demand, or installed capacity, it does not mean that the full capacity has been used during the exact period of 30 hours, but that the equivalent amount of current has been used. For example, a man may have an installed capacity of 5 kilowatts. In his case the first 30 hours' use of maximum demand would be 150 kilowatt hours, whether he used it during the first 30 hours or during any longer period. For example, he may only use this amount over the whole month. In the same way the next 70 hours' use of maximum demand represents a consumption of 350 kilowatt hours, as shown by his meter, the time during which it was used being immaterial. It will thus be seen that the ordinary meter is the only instrument required where such a rate is used.

In certain specific cases conditions of operation may be such that the maximum demand is less than the installed capacity. Under these circumstances, an arrangement mutually satisfactory to the consumer and the central station must be made on some other basis.

Power Plant Farthest North

A 45-kilowatt hydro-electric plant for light and power in the town of Chitina, Alaska, has just been put in operation. It was built by the owners, O. W. and M. S. Nelson, has been under construction for two years, and represents an outlay of $22,000, making it probably the highest priced, per kilowatt, plant in the world One of its distinctive features is that it is the farthest north of any year-round hydro-electric plant on the continent. Adjacent to the town of Chitina is a three-acre lake, which is fed by a number of springs, of such mildness that the lake does not freeze to any considerable depth even in the coldest weather. This lake is 100 feet above the Copper River and separated from it by a ridge. By driving a 1,400-foot tunnel through this ridge the water from the lake is carried over to the Copper River side, where it is dropped down a hundred feet through 270 feet of 16-inch steel pipe. The tunnel was driven through 900 feet of frozen earth and loose rock and through 500 feet of extremely hard, solid rock. The earth and rock were thawed with steam points.

Non-Twist Canopy Ring

A new invention eliminating the necessity of the objectionable slip canopies has been provided by T. D. Parmenter, of the Colonial Fixture Company, Ltd., which will be known as the "Non-Twist Canopy Ring." Full information and description will appear in a later issue.

Toronto Electrical Contractors' Association

WORKING RULES

1. Adopted by the Toronto Electrical Contractors' Association, for the guidance of its members, on May 2, 1918, in force from May 1, 1918, to May 1, 1919, and agreed to by Toronto Local 353, I.B.E.W. These rules are to be posted in the shops of the members.

2. Eight hours' labor shall constitute one day's work. All labor over eight hours per day shall be paid for at the rate of one and one-half hours' pay for each hour's work; work performed on Sunday and legal holidays shall be paid for at the rate of double time. All men shall be on the job, ready to commence work at the regular hours for starting work, which shall be between 8 a.m. and 5.00 p.m. Saturday to be a half-holiday; Saturday work between 12.00 noon and 5.00 p.m. to be paid for at the rate of time and one-half; and double time thereafter until relieved.

When workingmen are required to report at the shop, they shall report not later than 7.50 a.m., and shall be ready to receive orders or supplies. Failure to comply with this shall result in a reduction in pay for the time lost, and, if men are instructed to report at the shop for work and are not sent on a job, they shall be paid for two hours' time.

3. The holidays shall be legal and statutory holidays.

4. The help employed shall be divided into three classes: Journeymen, Junior Journeymen, and Helpers.

Journeymen shall have served at least your years at the trade, and shall have qualifications at least as required by the by-laws of Local 353.

Junior Journeymen shall be helpers who have served at least three years at the trade, and shall have qualifications at least as required by the by-laws of Local 353, and who shall be allowed to work for one year under instructions; that is, he shall be allowed to work as a Journeyman, but shall have no one but a helper under his supervision. Employers shall be entitled to employ one Junior Journeyman for the first four Journeymen and one for each four thereafter.

Helpers shall be those who have served at least one year at the trade. There shall not be more than one Helper for each Journeyman on any job. An employer shall have the right to employ one apprentice if employing four men on the average during the year.

5. The minimum wage of Journeymen shall be 55c per hour, and all Journeymen receiving now (April 1, 1918) more than 50c per hour shall receive a 5c per hour increase. (Employers are advised to satisfy themselves, when employing men, that men representing themselves as Journeymen are really qualified as such).

The minimum wage for first-year Helpers (one-year experience) shall be 25c per hour.

6. All carfare, other than that to reach the job or shop within city limits and return to his residence, shall be paid by the employer, either in cash or car tickets, at his option. All workmen working on jobs beyond the present city limits shall take car going to or return from work, which arrives at the present city limits as near 8 a.m. or 5 p.m. as car schedule will permit.

7. The Toronto Electrical Contractors' Association shall appoint two members to act with two members of Local 353 as a Joint Examining Board.

8. No employer of labor for the installation of electrical work shall be given any better terms or conditions regarding hours of labor, wages per hour, etc.

9. Employers, in case of work outside of Toronto, shall pay suburban car, railroad, or boat fare, and all expenses for room and board.

10. There shall be a Conference Board, consisting of three members of Local 353 and three members of the Toronto Electrical Contractors' Association. This Conference Board shall meet at least once each month, or at call of their chairman. All complaints by employer or employee, or covering labor conditions, must be submitted to the Board in writing. The Conference Board shall also work out and put into effect rules governing extra compensation to foremen. Rules and Regulations to govern the Board's transactions shall be made by the members thereof.

11. Any Journeyman, who shall do any work in violation of the Electrical Inspection Department's Rules, or in such manner so that it will not pass inspection, shall do said work properly on his own time and expense, or pay for same being done. (It being understood that, if such work is done by order of the contractor, the contractor assumes all responsibility as to it being passed by the Electrical Inspection Department, and expense for making work right). In the event of a Journeyman refusing to comply with this provision, the matter shall be referred to the Conference Board for investigation and, if the Journeyman be found responsible, the Local shall compel him to comply with said provision.

History and Development of Investigations Into the Nature of Light

By Mr. J. F. Heffron

Light plays so important a part in the life of man it is not strange that speculation as to its nature, and investigation of its laws, should have commenced at an early period of the world's history.

In their investigations and experiments, the ancients were seriously handicapped because they lacked the optical instruments so necessary to any scientific study of its phenomena. Hence they were unable to formulate any reasonable optical theory. All the refinements, both of construction and theory, may be said to have taken place within the last three hundred years.

Metallic mirrors, one of the simplest of man's devices to reflect light, are of very ancient origin. Many of these have been recovered from ancient Egyptian tombs, and we find that they are distinctly mentioned in the books of Exodus and Job. Burning glasses in the form of globes of water, or of glass, were also known at an early date. Aristophanes makes mention of them in a comedy of his which was performed about 424 B.C. But of optical instruments more delicate than these, we may reasonably assume that the ancients knew practically nothing.

It is surprising, therefore, to find that Pythagoras, the Greek philosopher, who died about 520 B.C., formulated one of the earliest, and at the same time one of the most reasonable theories in connection with the phenomena of sight. He believed, as did Sir Isaac Newton 2,000 years later, that the sensation of sight was caused by minute particles of some sort, being continuously shot out from luminous sources, which particles were supposed to in some manner enter the pupil of the eye.

We find Plato, with whom Greek philosophy attained to the culminating point of its development, speculating on the subject, but his hypothesis is so fantastic in its nature that we are unable to form any definite idea of his meaning, for, in addition to the lack of instruments so necessary in the observation of natural phenomena, the speculation of the Greeks had little or no basis on exact observation of nature, and was not supported by a patient mastery of natural law. They made many brilliant suggestions, but later generations did not, as in our times, immediately test and develop these suggestions by actual observation of nature, so that the dawning light of truth was not disclosed until many centuries had passed during which these early suggestions were lost sight of, and forgotten.

The Platonists were acquainted, nevertheless, with two very fundamental laws of light. They were aware of the fact that light travels in a straight line when it travels in a homogeneous medium, and were also aware that when a ray of light is reflected at any surface, the angle between the incident ray and the reflecting surface is equal to the angle between the reflected ray and the reflecting surface.

Ptolemy, the Egyptian astronomer, about 150 A.D., investigated the refraction of light both by glass and by water, but although he measured and tabulated the angles which the beam penetrating the glass of water makes with the surface, corresponding to certain angles which the incident beam makes with the surface, he was unable to determine the law which connected them.

Passing over centuries of inactivity in the realm of physics, we find Albazen, the Arabian, in the eleventh century, making a real advance in his description of the anatomy of the eye. He was able to show how it produced an image of external things on the retina. He also accounted for twilight, and for binocular vision, and made some real progress in the mathematical theory.

Little progress was made after this until the invention, in 1608, of the telescope, by Hans Lippershey, a spectacle-maker, of Middleburg. A little later Galileo independently constructed another telescope and, later still, about 1615, Kepler demonstrated how the magnifying power of the telescope may be calculated from the focal lengths of the lenses employed.

Snell, a professor of mathematics at Leyden, in 1621, discovered the laws of refraction which Ptolemy had been unable to deduce from his experiments, and died in 1626 without having published his results. Later, Descartes, having perused the dead Snell's papers, published the discovery as his own.

Glancing over the latter part of the seventeenth century we find that it was a period of extraordinary activity and advance in the science of optics. Now possessing finer instruments and the accumulated knowledge of those who had gone before, we find that scientists during the fourteen years from 1665 to 1678 made more important discoveries than had been made in all the preceding fourteen centuries, and it is these discoveries which mark the beginning of our present knowledge of the nature of light.

In 1665 Grimaldi published a treatise on light, in which he gave an account of some interesting experiments on "Diffraction" which name he applied to a small spreading out of light in all directions upon its admission into a darkened room through a small orifice. This spreading out of the light, he maintained, shows that it bends around corners the same as does sound, but, of course, to a smaller extent.

Newton's Investigations

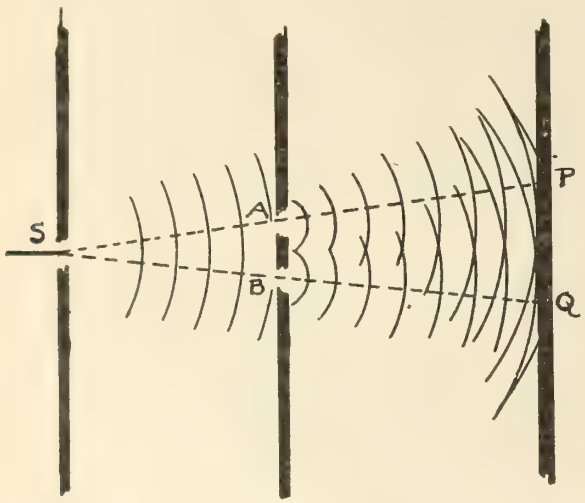
Sir Isaac Newton, in 1666, discovered the decomposition of white light into its component colors by means of a prism which he had chanced to purchase at Stourbridge Fair. He showed that no further colors were produced by a second refraction through a prism. He showed further, that when the component colors were recombined they once more produce white light. Newton explained that white light consisted of a mixture of the component colors, and that the function of the prism is to separate the components. Oddly enough this view, one of the most important beginnings of our modern knowledge of light, is one that we must abandon in favor of the view that the prism actually manufactures the different colors out of the white light, and we also have a pretty clear idea of how the manufacture is carried out.

Newton, when he for the first time projected the pretty rainbow tints of the light passing through the prism upon the wall, little suspected, even with his great mind, how that phantom riband of gorgeous colors would one day be called upon to draw many secrets from the messenger of the heavens traversing space in his thousand-league boots, secrets that scientific men of former times did not conceive of in their wildest dreams, and we may well suppose that the spectroscope has not yet told its entire story to man.

Newton carried on his experiments and finally developed with remarkable ingenuity the idea that light consists of exceedingly minute particles shot out from a luminous body, causing the sensation of sight when impinging on the retina.

This became known to the world as the "corpuscular theory of light," and, strangely enough, is the same as that advanced by Pythagoras, 2,000 years before. Newton's exposition of the theory was so masterly and his authority in the world of science so great, that with this theory he was able to retard the development of the later wave theory for fully a hundred years.

The wave theory, of which Huygens may be regarded as the author, and which became known as the "Undulatory theory," first appeared in 1678; it then supposed light to consists of waves of some sort emanating from a luminous surface. Huygens showed how reflection and refraction follow naturally from such a theory, but unfortunately was not able to show why light bends round corners so little. The



Dr. Young's experiment is diagrammatically represented above. Light of a certain wave length is admitted at a narrow slit S, and is intercepted by a screen in which there are two narrow slits, A and B, parallel to the first one. A screen receives the light emerging from the two slits. If the old corpuscular theory were true there would be two bright bands of light, the one at P and the other at Q, but instead Young observed a whole series of parallel bright bands with dark spaces in between them. Evidently the two small fractions of the original waves which pass through A and B spread out from A and B and interfere just as if they were independent sources.

answer to the objection now is, that light does bend round corners though only slightly, and that the smallness of the bend is quite simply due to the extreme shortness of the light waves. The longer waves are, the more they bend round corners. This can be noticed in any harbor with a tortuous entrance, for the small choppy waves are practically cut off, whereas a considerable amount of the long swell manages to get into the harbor. Huygens was unable to demonstrate this, and consequently the wave theory made little headway for over a hundred years.

Young, early in the nineteenth century, discovered the principle of interference. He was able to show how a beam of light may be divided into two portions, which under certain conditions will produce darkness when both portions illuminate the same point. As this follows quite naturally from any wave theory, as is more fully explained later on in this article, but would be inexplicable by a corpuscular theory, the long rivalry between the two theories came at last to an end, and the corpuscular theory was forced to yield entirely to the undulatory theory from this time onwards.

If light consists of waves they must, of course, be waves in some medium, and since light travels across space in which there apparently is no matter, we must suppose that the whole of space is filled with some unseen medium.

Much speculation as to the nature of this medium, which has been termed, in our day, the ether, has been indulged in. Even the ancient Greeks attacked this problem, and one of the chief ambitions of the early Greek evolutionists was to discover some one primitive substance or principle from which all the contents of the universe had been developed.

Huygens conceived of this medium as a kind of elastic solid, through which the vibrations of a luminous source are transmitted in much the same way as the vibrations of a marble embedded in a jelly are transmitted through the substance of the jelly.

This idea served for some time, and will, of course, still serve for those properties which light has in common with all other forms of wave motion, but it breaks down when properties involving the actual character of the waves are considered.

In the revival of scientific speculation Descartes recurred to an idea advanced by the brilliant monk Giordano Bruno, who was burned at Rome in 1600. Bruno had suggested that whirlpools or eddies in this ocean of ether might account for the movements of the heavenly bodies; just as corks swim round and round in the eddies of streams. As science advanced the theory of ether received a more solid justification. Experiment showed that the air in a particular portion of space—say, in the chamber of an air pump—might be withdrawn, yet something remained. A bell placed in the exhausted space may continue to work, yet no sound comes from it; but it remains visible, and so something must proceed from the bell to the eye. It was suggested, therefore, that a very fine all-pervading fluid remained, and the name of ether was eventually given to it. When the balloon was invented, and it was found that the atmosphere became thinner as one ascended and must cease altogether at about 200 or 300 miles above the surface of the earth, it was seen that something must occupy the vast regions of space beyond, in order to transmit light and electrical energy to us. Again, the ether was invoked, and light, heat, and electricity came to be regarded as wave-movements, of inconceivable rapidity, in this ether.

It was Clerk Maxwell who demonstrated the solidity of the theory of the ether when in 1873 he propounded his electro-magnetic theory and showed that the ether which was required for the transmission of light, was also required for the transmission of electric and magnetic actions, and that the known laws governing electric and magnetic actions, would lead to electro-magnetic waves, which have all the characteristics of light. When by the method of interferences the illustrous physicist Hertz was able to prove that electro-magnetic induction did not take place instantaneously as had until then been supposed, but according to Maxwell's theory propagates itself with the velocity of light, the issue was decided and it became known that the same fluid, the ether, which is the medium of luminous phenomena, is at the same time the vehicle of electrical action.

The Wave Theory of Light

We see, therefore, that the "undulatory," or wave theory of light took the place of the "corpuscular," or emission theory, because the latter theory was found inadequate to explain certain of the phenomena of light, of which the undulatory theory yielded a satisfactory interpretation.

The chief importance that the establishment of the undulatory theory of light held, lay in the part it played in the discovery of the existence of the luminiferous ether. We are now forced to the belief that all space, including intramolecular space, is fitted with an imponderable substance capable of transmitting vibrations, and hence that light is the immensely rapid molecular vibration of the illuminating body, which vibrations are transmitted through space by means of the corresponding vibrations of the imponderable substance pervading it.

The discovery of the real existence of this "ether" is

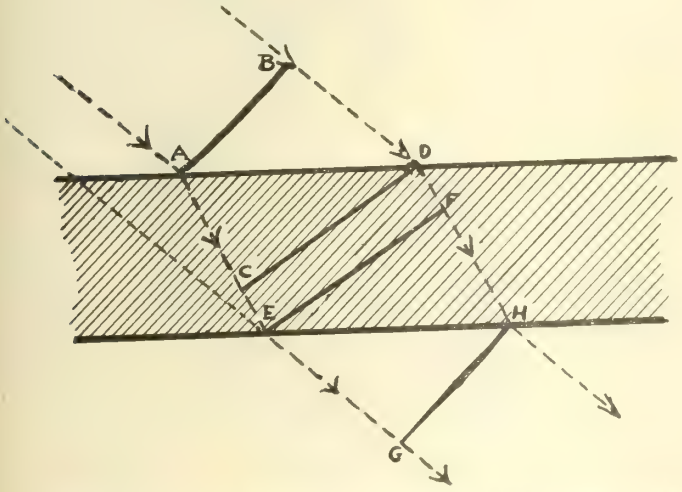
one of the great achievements of the Victorian era. Its character and mechanism are not yet known to us, for all attempts to invent a perfect ether have proved beyond the mental powers of the highest intellects, but the difficulty we experience in trying to picture to ourselves the nature of ether does not disturb our certainty of its existence. We have to attempt to picture it in terms of our experience, and our experience is confined to material things—that is to say, to what is called "ponderable matter," which has very different qualities. Optics is now a most elaborate science, filling volumes with its experiments, observations, and deductions. All these experiments proceed on the supposition that light is an electro-magnetic undulatory movement in ether, and there is not a single observation or result of experiment that does not harmonize with the theory.

We must then, for the present, be content with a knowledge of the fact that the ether exists, and must have existed from the beginning of the transmission of energy in all its forms, that it transmits these energies in definite waves and with a known velocity, that it is perfect of its kind, but that it still remains as inscrutable as gravity or light itself.

Some Characteristics of Light

We have seen, therefore, that any disturbance of the ether must originate with some disturbance of matter. An explosion, cyclone, or vibratory motion may occur in the photosphere of the sun. A disturbance or wave is impressed on the ether. It is propagated in straight lines through space. It falls on Mercury, Venus, the Earth, and every other planet or particle of ponderable matter met with in its course, and any mechanism, human or mechanical, capable of responding to its undulations indicates its presence.

Thus the eye supplies the sensation of light, the skin is sensitive to heat, the galvanometer indicates electricity, the magnetrometer indicates disturbances in the earth's magnetic field. We may look upon the magnificent generalization of

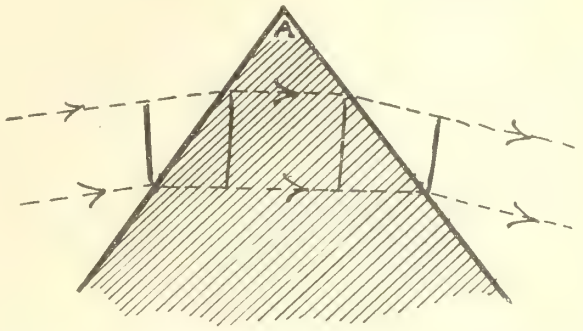


Refraction by Parallel Plate. If a plane wave passes through a plate of glass with parallel surfaces it is evident that at the second surface it will be deviated through the same angle into the original direction, the wave being simply displaced sideways by its passage through the plate. AB, CD, EF, and GH, in Fig. 2, represent successive positions of the wave-front passing through the plate, which is shaded. The amount of sideways displacement depends upon the obliquity of the wave to the surface as well as on the thickness of the plate. The displacement is evidently zero when the wave is parallel to the surface and is greatest when the obliquity is greatest, i.e., when the wave-front is almost perpendicular to the surface.

Clerk Maxwell that all these disturbances are of the same kind, differing only in degree, as one of the greatest scientific achievements of our time. Light is an electro-magnetic phenomenon, and electricity in its progress through space we find follows the laws of optics.

Accepting, therefore, the undulatory theory, we may briefly summarize the leading points in the science by considering the salient characteristics of a ray of light.

We have observed that light travels in waves, or a periodically recurring displacement or disturbance from a condition of staple equilibrium. These displacement waves occur in the luminiferous medium or ether. When extremely short, they are generally known as ultra-violet light, and are invisible to the human eye, when longer they form visible light; and longer still, they once more become invisible and produce radiant heat waves; while beyond that they form the



Refraction by a Prism.—If the second surface of the plate is not parallel to the first we have a prism. After passing through a prism the direction of the wave is altered as well as being shifted sideways, for the wave on reaching the second surface is not inclined to it at the same angle as it was to the first surface and therefore it will not be bent back by the same amount. Fig. 3 shows successive positions of a plane wave-front passing through a prism.

Hertzian waves employed in wireless telegraphy. These waves when produced in a modern wireless apparatus are miles in length.

Any wave which is propagated in a medium possesses three principal features. It must have (1) a certain wave-length, just as waves in the ocean have a length when measured from crest to crest; (2) a certain period, i.e., the time taken by any portion of the medium affected by the wave to describe one complete vibration; (3) a certain amplitude, i.e., the distance on each side of the position of undisturbed rest through which the portion of the medium vibrates to and fro, and corresponding, in the case of ocean waves (to continue the metaphor of a wave), to the height of the crest or the depth of the trough, measured from the ordinary undisturbed sea-level.

Combining the first and second of these characteristics, it is seen that the velocity of propagation of the wave, as a whole, will be equal to the wave-length divided by the period. So delicate is the apparatus of research used by the modern physicist that it has been possible to measure the length of these waves (from crest to crest) and it is found that the waves which are calculated to make an impression on our organs of perception range between the 1-40,000th and 1-80,000th of an inch. In other words, they must impinge on our nerves at the rate of between four hundred and eight hundred billion per second. That there exist wave-lengths which lie beyond the visible part of the spectrum, and which are either too short or too long to affect the retina of the human eye, is a fact well known to all students of physics.

The different periods of light waves can be deduced from the relation to the speed of light. The term frequency is used occasionally instead of period; it stands for the number of vibrations per second, and therefore is the reciprocal of the period, while the amplitude of a light wave is the factor which governs the intensity of the ray, for with light of a given wave-length the energy in the ray is proportional to the square of the amplitude. The speed of light in its movements through space has been determined by different methods, each of which show that its most probable value is about

186,000 miles per second, and that it is the same for all wave lengths.

From the fact that light consists of an undulatory motion in the ether, it is possible to explain the important phenomena which arise when rays from two separate sources meet at a point.

Analogous cases can again be found in ocean waves and the phenomena of the tides. If, owing to any cause, two series of waves from different sources affect the same water surface, there may occur the case where crests of waves in one series unite with crests of the other series. In this case the resultant wave has an amplitude equal to the sum of the component amplitudes.

But in the case where the crests of one series meet the troughs of the other, the resultant amplitude is the difference of the component amplitudes, and if these are equal there is no disturbance of the sea-level.

Similarly, it is quite possible to produce a combination of rays which will give either increased or diminished brightness. This is known as interference, and is illustrated by Fig. 1.

Another group of phenomena is due to the fact that the vibration of the ether, being perpendicular to the direction of the ray, may be confined to one particular plane. The light is then said to be polarized in that plane. Further, since harmonic motions in directions inclined to each other can be combined so as to produce circular or elliptic motions, we can combine polarized rays in a similar manner. So long as a ray travels in the same homogeneous medium, it does so in a straight line. But when it arrives at the surface of separation between two media which are optically different, a change takes place. One portion of the ray may be thrown backwards into the medium in which it has been travelling, and is thereby reflected, while another part may be reflected in a diffuse or irregular manner, and it is by this diffuse reflection that we see most objects which are not self-luminous.

A third part may pass into the second medium, but in doing so its direction suffers an abrupt change, and is said to be refracted, or bent. This peculiar property of light is made use of in the use of the prismatic lens to direct light in the direction desired, and is illustrated in figures 2 and 3.

Lastly, a certain portion may be absorbed by the second medium and its energy transformed into heat. A perfectly dull black surface may be said to absorb all the light which falls upon it and reflects or diffuses none of it back, except as heat.

Having given in outline the principal phenomena observed in connection with light, and having also traced the main outlines of the development of the various attempts to explain its phenomena we desire in conclusion to point out that at present the line of advance in physical optics seems to be towards some satisfactory explanation of the manner in which luminous matter transfers energy to the ether so as to produce vibratory motion.

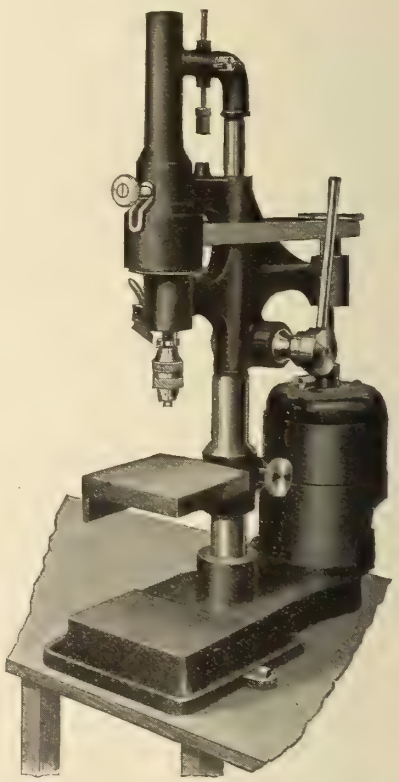
The most promising explanation seems to be that, associated with each atom (or perhaps constituting each atom) there are electrically charged particles or electrons, whose mass is mostly, if not wholly, electro-magnetic mass, and whose motions give rise to ether waves. This resolves itself into the necessity of formulating some hypothesis concerning the basic stuff of which the material world is made, and it is strange that the conception the physicist or chemist of the present day forms of this basic stuff is fundamentally the same as that of the earlier philsophers. These ultimate corpuscles, which are generally called electrons, are looked upon as minute structures or condensations of ether. We do not know their real nature, as we do not know the nature of ether. Some conceive of them as vortices ("whirlpools") in a continuous fluid; some think ether a finely granulated substance which is more condensed at these points which we know as electrons.

But when we reflect that these corpuscles are able to travel at 100,000 miles a second, and are so minute that more than a thousand of them have space to execute their prodigious movements within the limits of an atom of hydrogen (which in turn is so minute that billions of them might circulate, at relatively vast distances, within the confines of the letter "o"), we shall hardly expect very precise descriptions of them.

The question is both deep and wide. The future may see great changes in our present notions concerning this phenomena, but that is a problem for the future. Those who are impatient of the actual uncertainties of scientific men should reflect at times on what scientific men have decisively learned for us, and compare it with what people thought about nature five hundred, or even one hundred, years ago.

Electric-Driven Sensitive Bench Drill Press

A bench drill press with several novel features has recently been developed by the High Speed Hammer Company, of Rochester. The press is suitable for all work ranging from the smallest to a 3/16 in. hole. The height of the drill is 24 inches over all and the base is 7½ x 18 inches. The standard spindle speeds are 2100 to 6000 r.p.m., but special pulleys can be furnished to give a main spindle speed of



10,000 r.p.m. The drill is so constructed throughout to insure great accuracy in the work. The main spindle is heat treated and ground to size; it is guided through a bronze quill with an annular ball bearing support at each end. End thrust is taken up by an end thrust ball bearing under the feed arm. A depth gauge is also provided on the feed arm arranged so it can be locked in position. The drill is equipped with 1/10 horse-power, vertical Robbins & Myers motor.

The gross earnings of the Southern Canada Power Company for the half-year ended March 31 totalled $232,950, an increase of $45,292; the expenses $128,727, an increase of $32,327; and the net earnings $104,222, a gain of $12,965.

Personals

Mr. Raymond Beaudry, advocate, has been appointed Secretary of the Montreal Tramways Commission.

Mr. C. F. Sise, general manager of the Bell Telephone Company, has been elected president of the Canadian Club, Montreal.

Mr. Charles Johnson, of Oakville, Ont., has been elected a member of the Canadian Society of Civil Engineers. Mr. Johnson is engineer of the Toronto and York Radial Railway.

Mr. George L. Guy, in private practice as an electrical engineer, at Winnipeg, has been elected a member of the Canadian Society of Civil Engineers. He is also engineer of the Public Utilities Commission of Manitoba, being formerly electrical engineer for the city of Winnipeg.

Mr. A. W. Eshelby, formerly with the British Columbia Electric Railway Company, has entered the railway department of the Westinghouse Electric and Manufacturing Company at Seattle, and will have charge of railway motor equipment and control work in the Seattle territory for the company.

Mr. C. A. Lee, of the engineering staff of the British Columbia Electric Railway Company, left on April 20 for Washington, D.C., to join the United States navy civil engineering corps, with the rank of lieutenant. Mr. Lee was in charge of the work at Coquitlam dam in 1911 and the hydro-electrical installation at Jordan River, near Victoria, from 1912 to 1915.

Mr. W. S. Ford, lieutenant Royal Garrison Artillery, 122nd Siege Battery, B.E.F., who in the past has been assistant hydraulic engineer with the Canadian Boving Company, designing water-power plants, Diessel engine plants, etc., and also with the Western Canada Power Company, Stave Falls, B.C., on power-house construction, waterways, surveys, etc., has been elected an associate member of the Canadian Society of Civil Engineers.

Mr. Frederick John Bell, of Toronto, president and general manager of the Canada Wire & Cable Company, has been elected a member of the Canadian Society of Civil Engineers. Mr. Bell is also vice-president of the St. Catharines Steel and Metal Company; manager for Mr. E. A. Wallberg, C.E., Montreal, and acts in an advisory capacity for the Laurentian Power Company,. For several years he was on the staff of the Canadian General Electric Company.

Mr. John Murphy, electrical engineer, Department of Railways and Canals, has been appointed the duly authorized agent of the Fuel Controller for Canada to promote the substitution of hydro-electric power for steam power, having in mind the conservation of coal. Mr. Murphy has served a long apprenticeship in the telephone, and the electric light, power and railway field, which experience is proving of great value to the various federal controllers, commissions and departments with which he is now associated.

Captain Paul F. Sise, general manager and vice-president of the Northern Electric Company, Ltd., who was for some time in the United States with the staff of the British Recruiting Commission, has returned to Montreal, for the purpose of special work in connection with the recruiting of Jewish young men for the Jewish battalions now being raised in Canada and the United States for service with the British expeditionary force in Palestine. The work will include Jewish recruiting all over the Dominion, and Captain Sise will visit other Canadian cities. The battalions will be mobilized at Windsor, N.S.

Mr. W. R. Bonnycastle, of Vancouver, has been elected a member of the Canadian Society of Civil Engineers. Mr. Bonnycastle is a consulting hydro-electrical engineer, specializing on water-power development, and is also engineer for the Bridge River Power Company and the Indian Power Company, B.C. As well as being connected with Mr. R. S. Kelsch, of Montreal, on the design of the Kaministiquia power development, Fort William, he was electrical engineer with the Stave Lake Power Company, designing engineer with the Western Canada Power Company, and engineer for Smith, Kerry & Chace.

W. H. Banfield & Sons will move their fixture department from Adelaide Street to a new sales and showroom at 80 King Street West, about June 1st. They will install a complete range of fixtures, glassware, piano and table lamps, silk shades and all classes of fixture accessories. This location is in the center of the electrical district in Toronto and will be very convenient for out of town customers.

The Siemens Company of Canada, Ltd., Montreal, has obtained an order from the Department of Public Works, Ottawa, for 17 knots of submarine cable for delivery at Halifax and Vancouver. The cable will be manufactured at the company's works, Woolwich London, Eng.

The Montreal office of the Jefferson Glass Company, Limited, has been moved from the Royal Trust Building to the 10th floor of the Guarantee Building, 285 Beaver Hall Hill.

The electricians in the employ of the city of Vancouver have been given an increase of $20 per month, which will make their monthly wage $145 and $125 flat, instead of the union scale they formerly advocated of $6.30 for a day of eight hours, with double pay for overtime.

The Canadian Tungsten Lamp Company, Limited, of Hamilton, have issued a booklet entitled "Blue Label Lamp Data Book." It is well illustrated and contains a quantity of useful information.

The Prince Rupert Hydro-Electric Company has offered the city of Prince Rupert their plant at Falls River, including all improvements, for $34,000 in municipal bonds, and the offer is being given consideration.

The Canadian Refrigerating Plant, of Victoria, plans changes in their equipment, amounting to $25,000. The capacity of the plan is to be increased by the installation of machinery equipped for electrical operation.

For the Amateur Gardener

Garden Steps—by Ernest Cobb; Silver, Burdett & Company, Boston, publishers; a manual for the amateur in vegetable gardening. These are days when practically every householder, whatever his down-town business may be, is interested in the utilization of some small plot of ground for increasing food production. Experience has shown, however, that there is a very considerable percentage of wasted energy, due to lack of experience or knowledge of the rudiments of vegetable gardening. In this connection we are pleased to have located an up-to-date little book which covers briefly and practically most of the operations with which amateur gardeners are concerned. As the author states in the preface, he has endeavored to gather into small space "the necessary information regarding the culture of each important vegetable for the home garden and arrange it so that the amateur may take each necessary step in its proper turn, guided by clear, explicit directions." The book comprises 225 pages, nicely illustrated, of the most readable, helpful, and practical information the writer has seen.

Current News and Notes

Collingwood, Ont.

The Water and Light Commission of Collingwood, Ont., have contracted to supply a further block of 800 h.p. to the Collingwood Shipbuilding Company. Additional transformer and sub-station capacity will be required.

Halifax, N.S.

As a result of a plebiscite on the Halifax Power Company question the city has been authorized to advance the company $400,000, receiving in return a mortgage for $400,000 and 51 per cent. of the stock of the company. The company receives a 25-year contract for street lighting at $30,000 a year.

Morrisburg, Ont.

The New York and Ontario Power Company have made application to the International Joint Commission for approval of plans to reconstruct their dam and plant at Waddington, on the St. Lawrence. The company propose to construct a new dam and power-house.

Niagara Falls, Ont.

The Niagara District Independent Telephone Company, which has been serving the peninsula farmers for years, has sold out to the Bell Telephone Company.

Quebec, Que.

The Levis County Railway have made fare increases amounting to practically 100 per cent.

Regina, Sask.

The City Council of Regina, Sask., are considering a 20 per cent. increase in light and power rates. The cost of operating the power plant is said to have been $55,000 more last year than was anticipated.

Sault Ste. Marie, Ont.

Fire, on the morning of May 2, destroyed the old power station of the Great Lakes Power Company, Sault Ste. Marie, Ont. The new plant, however, was not affected. Temporary installation was made to take care of the street railway and a portion of the d.c. power formerly supplied by the old plant. As yet it has not been decided what action will be taken, but it is very probable that, rather than reconstruct the old plant, an extension will be made to the new plant. The latter was designed so that it could be readily extended.

Toronto, Ont.

Notice has been given to customers of the Toronto Electric Light Company of a minimum charge of 50 cents a month on all domestic connections. The company will benefit chiefly during the summer months when houses are closed.

The Toronto Street Railway Company have now definitely decided to employ women conductors. They will receive the same pay as the men, although it is possible they may work on shorter shifts.

The gross receipts of the Toronto Street Railway Company for the month of April were $543,054.77, and the city's percentage $108,610.95, as compared with gross receipts of $510,334 for the corresponding month last year, with the city's percentage at $102,066.98, or an increase in the interests of the [illegible] $6,543.97.

Vancouver, B.C.

The West Kootenay Power Company has begun preliminary work on the high-power line from Rossland to the Canada Copper Corporation, at Copper Mountain, near Princeton. The extension will be about 180 miles long, and is expected to cost, including laterals and sub-stations, between $2,000,000 and $2,500,000.

The Kootenay General Hospital, Nelson, will soon be equipped with an electric lighting system if the plans under consideration are carried out. The cost of the work is expected to be about $1,180.

The electrical equipment, including lighting and power, in the assembling plant of the Imperial Munitions Board at Victoria, was installed by C. H. E. Williams, contracting electrical engineer, Securities Building, Seattle.

Winnipeg, Man.

Jitneys have now been permanently banished in the city of Winnipeg.

The Winnipeg Street Railway Company, it is said, will immediately pay the city $105,000 due on 1917 percentages, grant salary increases to the amount of $82,000 a year, and install a system for the protection of the city service mains from electrolysis.

Trade Publications

Mellowlight—Bulletin R, issued by the Canadian General Electric Company, describing "Mellowlight" semi-indirect lighting fixtures; illustrated.

Condulets—Condulet Suggestion No. 27, by the Crouse-Hinds Company of Canada, showing an actual installation of Type FHF condulet, which makes an ideal fitting for control of household heating devices; manufactured strictly in accordance with the Code.

C. G. E. Publications—Bulletin No. 44678, describing drum type controllers for railway service. Also leaflets describing tank lifters for G-E type F, forms K5 and K13, oil switches; G-E oil switches for pole line service, Type F, Form P7, and Thomson direct current astatic watthour meters for switchboard service.

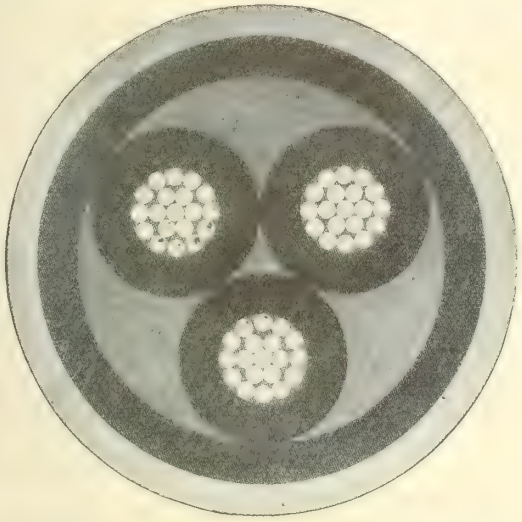
M.S.L. Batteries—The Canadian Hart Accumulator Company are distributing a handy pocket-size catalog giving complete data regarding the care, maintenance, and repair of storage batteries in general and also comprising complete replacement data showing the various types and sizes of batteries used on all makes of automobiles and the M.S.L. battery suitable for each model.

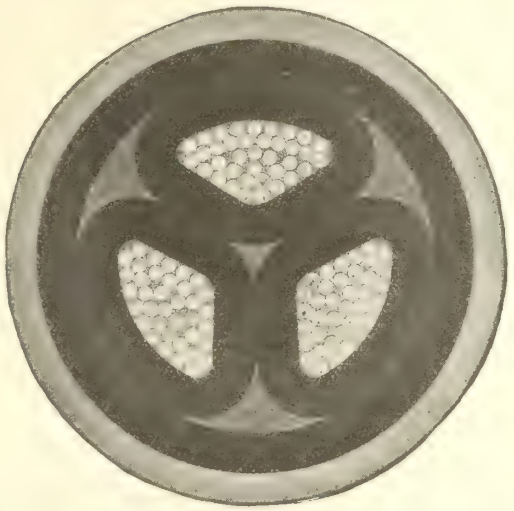
Rheostats—Circular No. 501, by the Ward Leonard Electric Company, describing their "Universal" battery-charging rheostats for garage service. The booklet describes a very useful and efficient series of present-day equipment. The Ward Leonard Electric Company have also issued Bulletin No. 50, which describes in detail the method of determining the proper size of a battery-charging rheostat.

"Electrical Equipment for Cement Mills"—Circular No. 7174, just issued by the Westinghouse Electric and Manufacturing Company. The pamphlet has an attractive art cover, illustrating the interior of a motor-driven cement mill, while numerous photographic reproductions are given throughout the publication, showing the application of motors to various types of machinery employed in cement mills. Advantages of motor drive for this class of service and characteristics required by motors to be specially successful are given briefly.

PHILLIPS' CABLES

as supplied to the Toronto Hydro Electric System





These illustrations show cross sections in the original size of cables recently supplied to the T. H. E. System and reordered by them for further extensions. The specifications are as follows.—Conductors composed of 37 strands each, .082 in. diameter. Thickness of dielectric on each conductor, .210 in. Thickness in belt, .210 in. Thickness of lead sheath, .160 in. Overall diameter, 2.61 in., 250,000 C.M. Three Conductor, Paper Insulated, and plain Lead Covered Cable for 13,200 volts. We can supply you with wires and cables of any size for Power, Lighting, Telephone, Telegraph, etc.

Write us for detailed information.

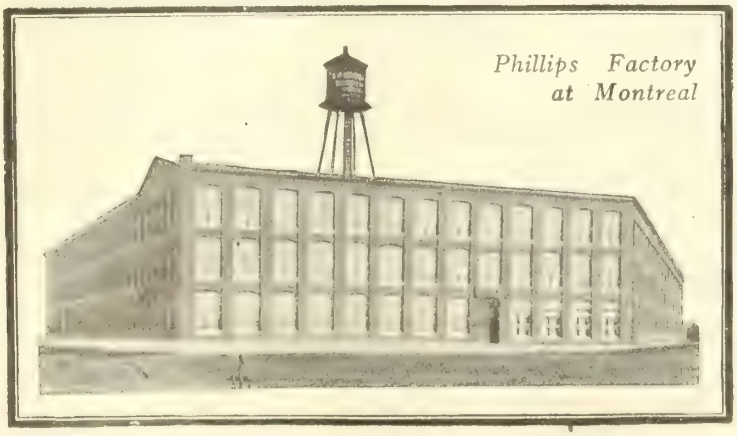
NOTE.—Specification of cable in left-hand cut: 3/0 B. and S. Three conductor. Each conductor 19 strands, each .094 in. diam. Thickness of dielectric on each conductor, .21 in. Thickness of dielectric on belt, .21 in. Thickness of lead sheath, .15 in. Overall diameter, 2.60.

Specification of cable in right-hand cut: As stated in copy.

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Branches: Toronto Winnipeg Regina Calgary Vancouver



Phillips Factory at Montreal

FOR SALE

[illegible] tungsten or nitrogen, 5-light cluster fixtures, 20" [illegible] porcelain enameled steel reflector. Malleable iron cross arms, pony glass insulators. High tension mica insulating joint, tested to 30,000 volts. In service for short time. 200 Majestic Balls, 12 in. x 12 in. x 6 in. fitter. Entirely new.

Full description regarding the above apply to Galt Hydro-Electric Commission, 50 Dickson St., Galt, Ont. 10-11

POSITIONS VACANT

WANTED—Draftsmen with experience on transformers, induction motors, or direct current machines. Apply stating experience and salary expected, to Box 731, Electrical News, Toronto. 9-11

WANTED—Several experienced draftsmen, more particularly those having experience in switchboards, also draftsmen having experience in generators and transformers. In applying state previous experience, where at present employed, salary expected. Apply Works Engineer, Canadian General Electric Co., Peterboro. 10-11

Increased Use of Electric Vehicles in England and Ireland

The high price of gasoline (it is now costing more than $1 per imperial gallon) and the multiplying of electrical supply stations are said to be creating a new demand for electric vehicles for both pleasure and commercial purposes in the United Kingdom. It is not supposed that such demand can be met by British manufacturers, as long as their energies are being devoted to supplying government needs, but after the close of the war there will in all probability be a marked development along this line, since to maintain and operate certain electric vehicles will be more economical, and there will undoubtedly be standardization of construction. It is thought that through standardization it will be possible to construct a two-seated runabout complete for less than $500, and a half-ton tradesman's van for about $750.

The raailroad companies are using them extensively, and in other lines of business, as well as for municipal use, the demand for them cannot be met. In some cities electric power has been adopted for omnibus service At pre-war rates for gasoline the relative over-all costs of running petrol and electric omnibuses worked out practically 17 and 15 cents per car-mile. The cost of gasoline has advanced 250 per cent., whereas the advance in cost of electrical energy has been only about 10 per cent. In many places in England power for commercial electrics can be obtained for 2 cents per unit. An electric passenger car travels nearly, if not quite, a hundred miles on a single battery charge.

A report by Electrical Engineer T. W. Bloxam to the Tramways and Electricity Committee upon electric compared with petrol vehicles was presented to the City Council of Belfast recently.

The report states that in May, 1915, the department commenced using an electric wagon with a nickel-iron battery in place of a petrol-driven wagon, for the ordinary repair work of the overhead equipment, and a material saving in cost had resulted, as the greater facility for starting, stopping, and manoeuvring in traffic more than counterbalanced any loss of time on the road, unless the journey was to a distant part of the city. During the 2¼ years ended July, 1917, the electric wagon ran 7,398 miles, and used 6,651 units of electricity (0.89 units per mile), the cost per unit for the past year being 1.137d. per unit. The petrol vehicle ran 5,800 miles, and used 1,621 gallons of petrol (0.28 gallon per mile), the cost per gallon being 2s. 3¾d. Therefore, during the year to March, 1917, the "electric" cost 1.01d. per mile for electricity, and the "petrol" cost 7.77d. per mile for petrol, a difference of 6½d. per mile, or £70 per annum.—N. E. L. A. Bulletin.

PETRIE'S LIST

of New and Used

MOTORS

FOR IMMEDIATE DELIVERY

No.	H.P.	Phase	Cycle	Volts	Speed	Maker
1	100	3	25	550	750	Westg.
2	40	3	25	550	710	Westg.
2	35	3	25	550	720	Westg.
1	20	3	25	550	500	C. G. E.
3	15	3	25	550	750	C. G. E.
4	10	3	25	550	720	Westg.
2	7½	3	25	550	750	C. G. E.
2	4	3	25	550	1400	Excelsior
2	3	3	25	550	750	C. G. E.
2	2	3	25	550	1400	Excelsior

30 to 60 DAYS' DELIVERY

2	75	3	25	550	750	C. G. E.
1	50	3	25	550	750	Westg.
1	35	3	25	550	750	C. G. E.
1	20	3	25	550	750	C. G. E.
3	10	3	25	550	750	Westg.
4	5	3	25	550	750	Westg.

Write Us for Prices

H. W. PETRIE, Limited

Front St. West - Toronto, Ont.

READ THIS!

$2,900 for

275 K.V.A. 25 Cycle
6600 Volt, 3 Phase
275 R.P.M. Generator
or Synchronous Motor

Brand New

Fully Equipped Sw-Bd. and Exciter

ALSO

3—100 K.V.A. 25 Cycle New Transformers S.P. 13,200 to 6600/2200 Volt

$900 each

To be sold immediately

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Incandescent Lamp Cord, Flexible Switchboard Cables, Special Cords and Cables for all kinds of Electrical Work.

Prompt Shipments from Canadian Factory.

BOSTON INSULATED WIRE & CABLE CO., Limited

Canadian Office and Factory, HAMILTON, ONT.

Ready for Immediate Delivery

ALTERNATING CURRENT

2—100 K.W., General Electric, 3 phase, 60 cycle, 2300 volt generator, type GTB, form D, complete with switchboards.

1—200 KW., 3 phase, 60 cycle, 1100 volt, General Electric generator, type GTB, form D, speed 600.

1—450 K.V.A., 2300 volt, Allis-Chalmers, 200 speed, 3 phase, 60 cycle generator, 2 years old, good for direct connection for engine drive or water wheel drive.

1—100 H.P. new Westinghouse motor, 3 phase, 60 cycle, 550 volt, 900 speed.

1—100 H.P., new General Electric, 3 phase, 60 cycle, 440 volt, 720 speed, slip ring, complete for heavy starting duty.

1—50 H.P. new General Electric, 440 volt, 1200 speed, 3 phase, 60 cycle, slip ring motor.

1—50 H.P. General Electric, 220 volt, 900 speed, type I, form L.

2—50 H.P. new Allis-Chalmers, 550 volt, 3 phase, 60 cycle, 900 speed motors.

MOTOR GENERATOR SET

1—40 KW., 125 volt, General Electric, 720 speed, type CL, form B, 6 pole generator, connected on one sub base to a 60 H.P., 3 phase, 60 cycle, 2080 volt, 720 speed, type M, form C, Fort Wayne motor in A1 condition and complete. Three bearing machine.

DIRECT CURRENT

2—100 H.P., 110 volt, Holtzer-Cabot D.C. motors, 550 r.p.m., full commutators.

1—10 KW., 125 volt, Bullock, 400 speed, marine set, direct connected on one sub base to a Westinghouse vertical engine.

1—50 KW., 125 volt, General Electric, 280 speed, type MP generator, direct connected to an 11 x 12 vertical marine type engine.

1—300 KW., 500 volt, D.C. General Electric generator, 400 r.p.m.

1—56½ KW., 125 volt Westinghouse, 800 speed, type M generator, complete and in A1 condition.

1—80 KW., 125 volt, Crocker-Wheeler, 750 speed, type CCD generator.

1—90 KW., 110 volt, General Electric, 690 speed, type CL, 6 pole, form B generator.

1—300 KW., 550 volt, General Electric, 400 speed, type MP generator, D.C.

BOILERS

3—300 H.P. Holyoke Manning Boilers, now located in Massachusetts; good for 150 lbs; 11 years old, in splendid condition.

5—150 H.P. Manning Boilers, now located in New Hampshire; good for 135-140 lbs. Immediate delivery.

6—90" x 18' 6" horizontal return tubular Dillon Boilers, now located in Rhode Island, installed in 1905, for delivery in 2 months.

SEND US YOUR ENQUIRIES

JOSEPH MYERSON, 274 Commercial St., **BOSTON, Mass.**

Selections from Our Stock of Motors
3 Phase, 60 and 25 Cycles

3 PHASE, 60 CYCLE MOTORS

Qu.	H.P.	Make	Volts	Type	Speed
1	¼	R&M	NEW. 110		1700
1	½	G.E.	NEW. . 110	KT	1800
1	½	G.E.	 110	I	1800
5	1	G.E.	NEW. . 220	KT	1800
1	1	G.E.	 220	KT	1800
1	1	Fbks.	M. .. 440	B	1200
2	2	G.E.	 220	KT	900
5	2	G.E.	NEW. . 220	KT	1800
5	3	Wstgh.	New 220	CS	1130
2	3	R&M	NEW. 220		1150
4	3	G.E.	 220	KT	1800
6	3	G.E.	NEW. . 220	KT	1800
1	3	G.E.	 220	KT	900
3	3	G.E.	 220	KT	1200
1	3	Cr.Wh.	. . . 220		1720
6	5	G.E.	NEW. . 220	KT	1800
1	5	G.E.	 220	KT	1800
1	5	G.E.	 220	KT	1200
3	5	Cr.Wh.	. . . 220	Q	1720
1	5	Cr.Wh.	. . . 550	Q	1720
1	5	Wstgh.	 220	CCL	1700
10	5	Wstgh.	New 220	CS	1735
3	5	Wstgh.	New 220	CS	1130
29	7	G.E. (motors only)	 550		1200
1	7½-15	Cr.Wh.	.. 220/440		865/1735
3	7½	G.E.	NEW. . 220	KT	1800
2	7½	G.E.	NEW. . 220	KT	1200
6	7½	G.E. (motors only)	 550	KT	1800
2	7½	G.E.	NEW. . 220	KT	900
2	10	G.E.	NEW . 220	KT	1800
4	10	G.E.	NEW. . 220	KT	1200
1	10	Wstgh.	 220	CCL	1700
1	10	Wstgh.	. .. 220	CS	1150
1	10	Cr.Wh. with resistance type starter	550	Q	1800
3	15	G.E.	NEW. . 220	KT	1200
2	15	G.E.	NEW. . 220	KT	900
3	15	R&M	NEW. 220		1150
3	15	Fbks.	M. 220/440	KBV	1200
2	20	Wstgh.	. . 220	CS	1160
1	20	Fbks.	M. . . 220	B	1200
50	20	Fbks.	M. 220/440	KBV	1200
19	25	Wagner	220/440	BP	1120
2	30	Wagner	NEW 220		850
1	35	G.E.	 220	KT	600
1	35	G.E.	 220	KT	720
1	35	Triumph	220/440		900
1	40	Wagner NEW.	220/440	BP	850
1	40	Fbks.	M. . . 220		900
2	40	G.E.	NEW. . 220	KT	1200
1	50	Triumph	. . 220		720
1	50	G.E.	NEW. . 220	KT	900
2	50	G.E.	NEW . 440	KT	900
1	75	G.E.	NEW. . 220	K	900
1	125	G.E.	2200	L	600
1	150	Wstgh.	New 440	CW	695
1	150	G.E.	NEW. . 220	M	580
1	200	G.E.	NEW. . 440	M	600

3 PHASE, 25 CYCLE MOTORS

Qu.	H.P.	Make	Volts	Type	Speed
1	5	G.E.	. . . 220	KT	750
1	12½	G.E. elev. type-high torque	220	KTE	750
6	15	Allis-Ch.	.. 220		750
7	20	Allis-Ch.	.. 220		750
2	20	G.E.	 440	K	750
1	40	Wstgh.	. . 220	MW	695
1	50	Allis-Ch. intermittent duty, sl. rg. drum controller	 440		500
1	55	Wstgh. sl. rg. 30 cycles, complete.	. 440		860
1	60	45/30 G.E.	440		500 375 250

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Safety Panels and Switchboards

For Office, Theatre and Factory Buildings

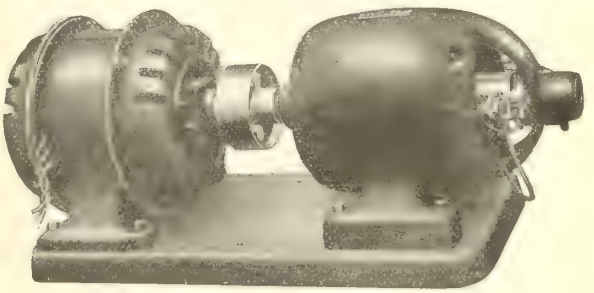
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Everything Electrical — Try us for Service

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Motor Generators and all Electrical Machinery

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Specialties

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Ammeter Plugs
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Porcelain Bushings

Ground Clamps

Marble and Slate

Send us specifications and we will quote you price.

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REFLEX
Spark Plugs



The REFLEX Line of Spark Plugs is a trade winner. They are made right—stay clean and keep the car on the go. A Gold Bond guarantee against defective material and workmanship is given with each plug.

Every customer satisfied — profits sure—a good line to handle for winning the good-will of motorists and users of engines.

Get the "Reflex" Agency.

Write for full particulars.

Great West Electric Co., Limited
61-63-65 Albert St., Winnipeg, Man.

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"ANTI-SULPHURIC" ENAMEL
The only reliable protection against the action of acid and chemical fumes.

"FERRODOR"
Rustproof elastic paint. Superior to Graphite or Red Lead. Defies all climatic conditions.

"DRIOROL"
Oil-proof Enamel. Dries quickly over greasy and oily surfaces. Not affected by lubricating or transformer oils.

"ARMOUR"
Fire-resisting paint, or colorless solution.

"ARMACELL"
Possesses the highest insulating qualities of any varnish on the market.

"OHMALINE"
Black, quick air-drying insulating composition. Also supplied for stoving, and as a solid insulating compound.

"SHAYDOLITE"
for coloring electric lamps. Used in the Royal Navy. Weatherproof. Dries rapidly.

"ARMABRON"
Bitumen protective paint, elastic, acid-resisting, weatherproof.

Made in London, England, by
GRIFFITHS BROS. & COMPANY
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Dealers in Electrical Specialties
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Will stand 30 to 50 MORE STRESS than the Welded Eye

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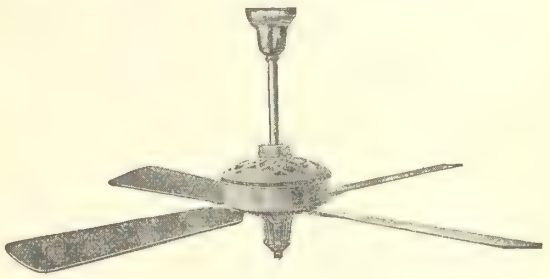
ERICO
Featherweight Portable Welder

The Rheostat shown above weighs 140 pounds, and the Welder weighs 65 pounds. The outfit installs standard ERICO Rail Bonds, and will operate on voltages between 250 and 750.

No flame or arc strikes bond or rail.

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THE ELECTRIC RAILWAY IMPROVEMENT CO.
CLEVELAND



Century

Alternating Current Ceiling Fans

58 inch blade sweep—
2 speed switch—
Quiet operating—
Electroliers can be attached at any time.

CENTURY ELECTRIC COMPANY
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Great West Electric Co., Ltd., Winnipeg
Rudel-Belnap Machinery Co., Ltd., Can. Express Bldg., Montreal
Rankin & Cherrill, 55 Hastings St. W., Vancouver, B.C.

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"The material of a thousand uses"

THE ANHYDROUS PHENOL RESIN COMPOUNDS

They excel in
Heat Resistance—Dielectric Strength—Mechanical Strength—Accuracy of Dimensions
furnished in
sheets, tubes, rods, granular, molding plastic, impregnating liquids.

Write us for our catalog.

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676 West 22nd Street, CHICAGO

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Kingston, Ont., Canada

Miners, Exporters and Dealers in Canadian Amber Mica.

Thumb Trimmed, Cut to Size, Splittings, Discs, Washers, Etc.

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Six Carloads of Electrical Merchandise

Most of it New — *Immediate Delivery*

Some of it Used — *Subject to Prior Sale*

25% to 50% Below Wholesale Prices

MOTORS

3 Phase 60 Cycle 550 Volts

No.	H.P.	R.P.M.	MAKE
1	2	1750	Wagner
7	2	1750	Lincoln
8	3	1750	Lincoln
1	5	1800	Thompson
1	5	1800	Ideal
5	5	1800	Lincoln
1	7½	1200	Lincoln
1	7½	1120	Canadian General Electric
5	10	1200	Lincoln
2	10	1120	Canadian Westinghouse
2	20	1200	Lincoln
2	20	450	Canadian General Electric
1	20	900	Lincoln
1	25	720	Canadian General Electric
2	25	900	Lincoln
2	25	900	Wagner
1	25	850	Swedish General Electric
1	25	900	Canadian General Electric
1	30	1120	Canadian Westinghouse
3	30	850	Lincoln
1	30	850	Wagner
2	30	1140	Wagner
7	35	900	Canadian General Electric
1	40	600	Canadian General Electric
2	45	1200	Canadian General Electric
1	50	900	Canadian General Electric
1	50	900	Wagner
2	50	850	Canadian Westinghouse
1	60	450	Canadian General Electric
2	75	450	Canadian General Electric
1	75	900	Crocker-Wheeler
2	75	1200	General Electric
1	75	900	Swedish General Electric
1	75	600	Crocker-Wheeler
1	100	900	Lincoln
7	100	900	Canadian Westinghouse
1	150	900	Canadian General Electric

TRANSFORMERS

60 Cycle

2200 Volts to 220-110 Volts

No.	K.W.	MAKE
11	¾	Packard
14	1	Canadian Westinghouse
18	1	Packard
13	2	Packard
15	2	Canadian Westinghouse
3	2	Can. Gen. Electric
6	3	Packard
6	3	Can. Westinghouse
50	5	Rideau
21	5	Can. Westinghouse
3	5	Can. Gen. Electric
4	10	Packard
2	10	Can. Gen. Electric
8	10	Can. Westinghouse
2	15	Can. Westinghouse
32	20	Can. Gen. Electric
1	25	Can. Gen. Electric
2	30	Can. Westinghouse
1	40	Can. Westinghouse
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Also two carloads of condulets, condulet covers, V. V. fitting, fuses, knife switches, porcelain tubes, cutouts, circular loom, flexible steel conduit and couplings, carbons, carriage bolts, braces and R.C.D.B. wire.

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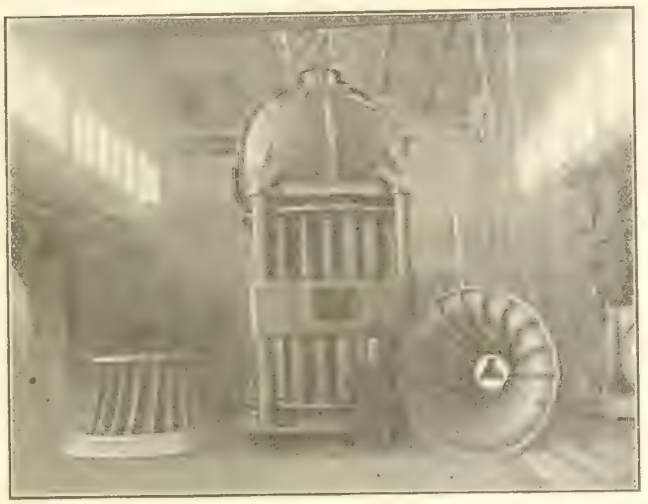
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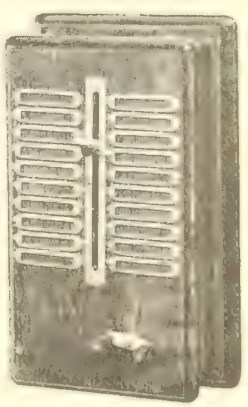
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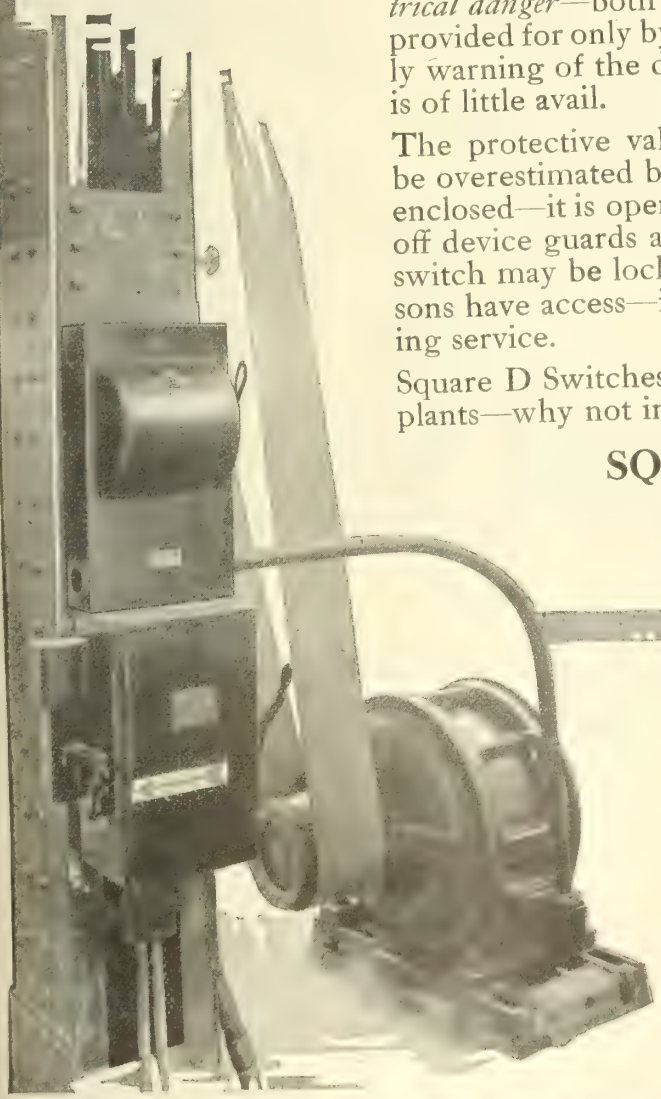
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(Continued on Page 46)

SQUARE D
STEEL ENCLOSED SWITCHES



Primarily there are two contributing factors in accidents to workers and machinery—carelessness and ignorance.

In their relation to the great industrial hazard—*the electrical danger*—both of these elements can be effectively provided for only by positive protective measures. Merely warning of the danger—because of its very nature—is of little avail.

The protective value of the Square D Switch cannot be overestimated because—all live parts are completely enclosed—it is operated by handle outside of box—lock-off device guards against accidental closing of circuit—switch may be locked so that none but authorized persons have access—it may be inspected without interrupting service.

Square D Switches are standard in many of the largest plants—why not in yours?

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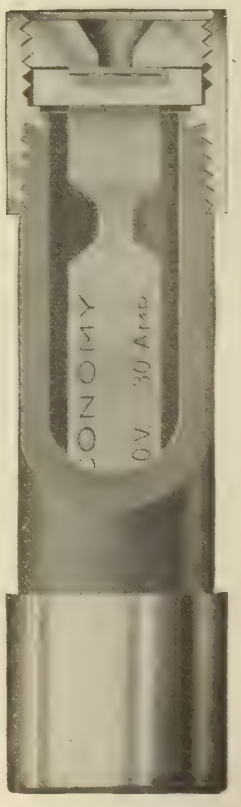
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protect millions of circuits and billions of dollars worth of property in thousands of plants representing every branch of industry.

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Get our prices. We can save you 35% customs duties. A test purchase will prove that ours are the

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FOR electrical wiring all joints must be equally strong, safe and proof against corrosion.

Allen Fluxes are the only ones approved by the National Board of Fire Underwriters.

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Ingot Sheet Wire Rod Tubing

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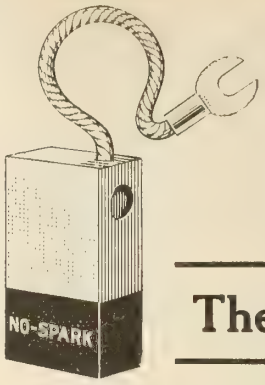
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Kuhlman Electric Co.
Bay City, Mich.



No Spark Brushes

They Don't Spark

because they don't cause friction in the generators. They don't crumble, crack or break. In hundreds of cases NO SPARK BRUSHES have outlasted 8 to 12 sets of ordinary brushes. Grades and sizes to suit all Electrical Machines. Let us prove our claims to you. Our engineers are at your service to insure proper selection of grade best suited for each machine.

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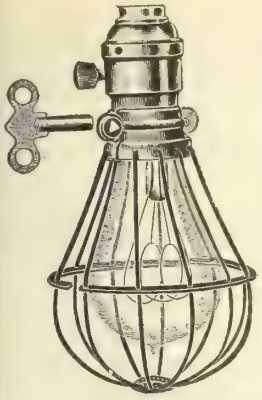
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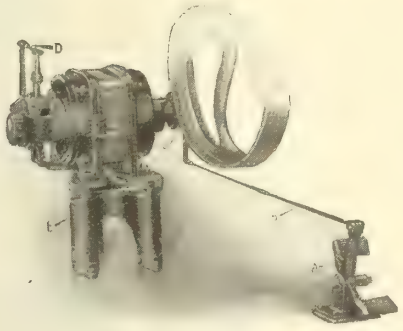
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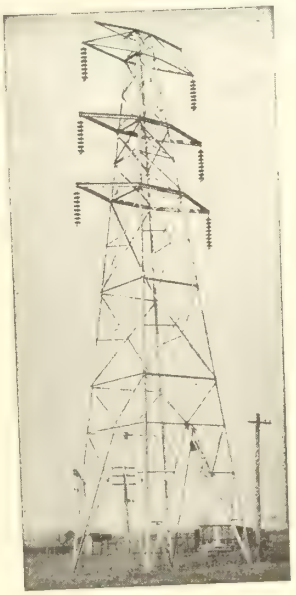
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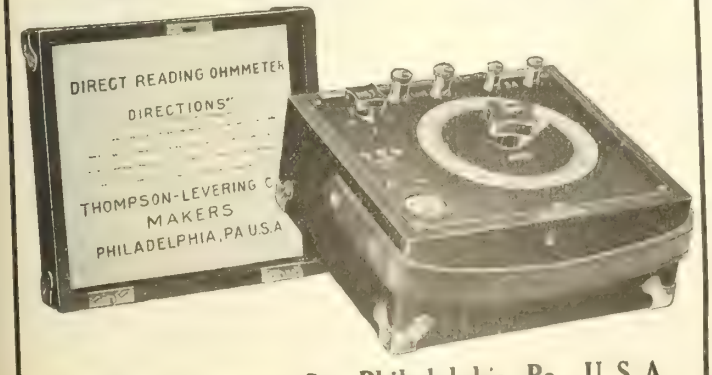
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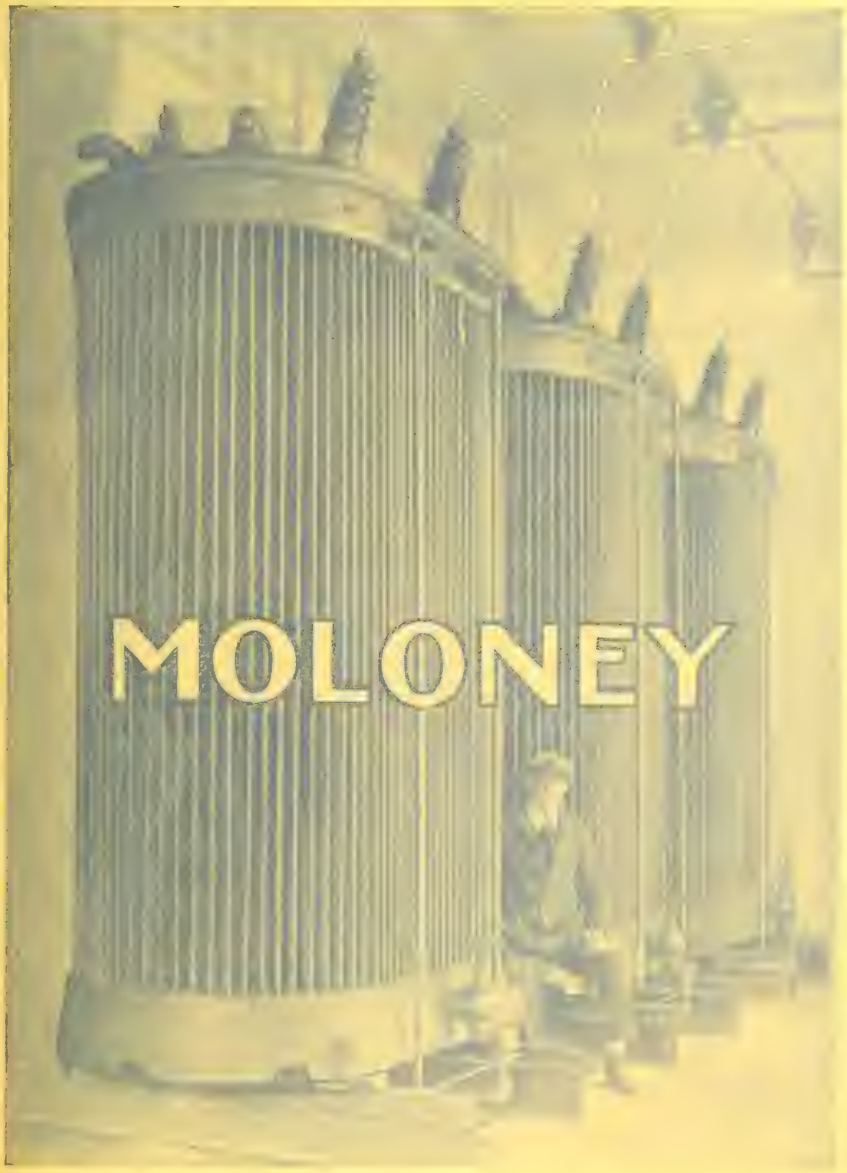
Are you prepared to meet the demand?

The National Electric Heating Co., Ltd., Toronto

Vol. XXVII No. 11 Toronto, June 1, 1918

Electrical News

Generation, Transmission and Application of Electricity



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Large supply of Service Transformers carried in stock.

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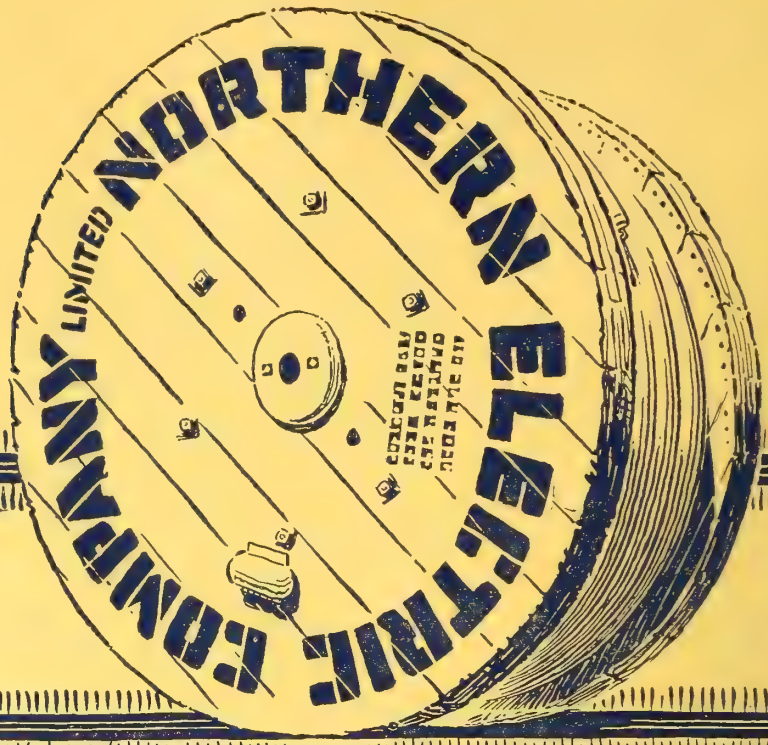
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In Halifax or Vancouver, whether on the public thoroughfares of our larger cities or smaller towns, wherever there is a cable installation in progress, the reels invariably bear the name of the Northern Electric Company, Limited.

The installation may be overhead, underground or submarine. It may be for a Telephone Company, a Telegraph Company, a Railroad Company, or for a street lighting system.

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Coffee Percolator, Pot Style. No. 11793. Holds 7 cups or 2½ pints. Finished in nickel; comes with cord and attachment plug complete.



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Pot Style, No. 11493. Holds 8 cups or three pints; finished in nickel; comes with cord and attachment plug complete.

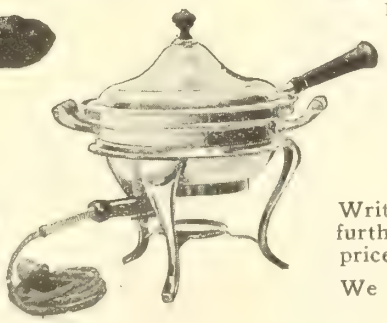
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N. E. B130 Toaster. Upright open Toaster, finished in nickel; comes with cord and attachment plug complete.



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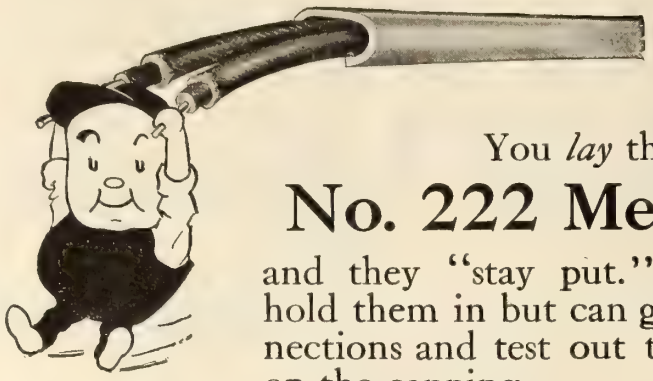
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On your next job refer to your copy of Bulletin 101 and place your order with your jobber.

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Give them good interior car lighting with "Safety" Car Lighting Fixtures.

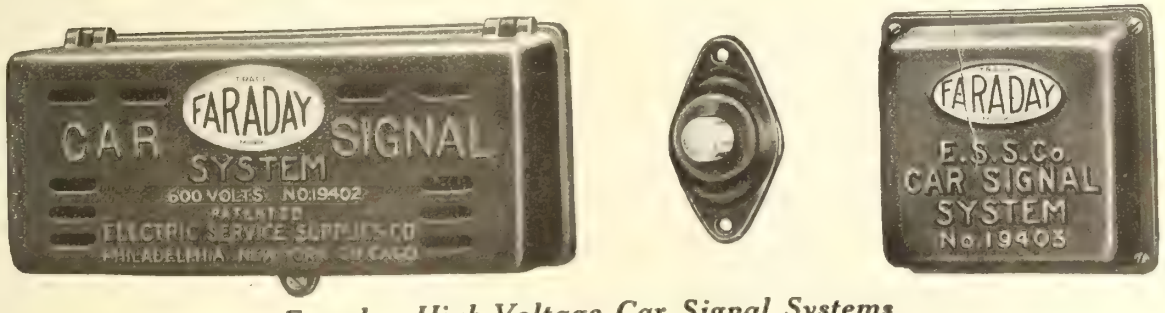
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Get the "Reflex" Agency.

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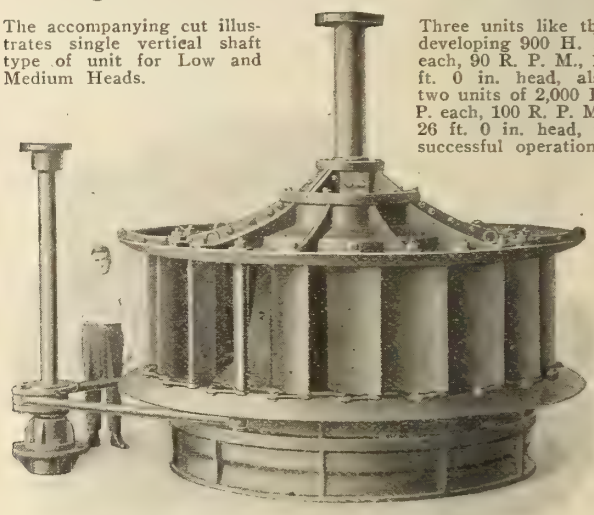
are prime factors in development of Water Power in these days of intense activity. That's why

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are being installed in the "PLANTS THAT COUNT"

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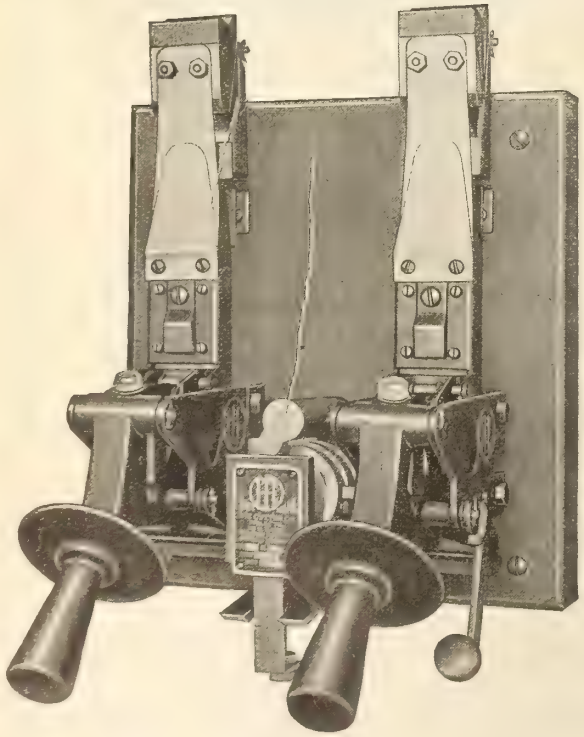
Three units like this developing 900 H. P. each, 90 R. P. M., 15 ft. 0 in. head, also two units of 2,000 H. P. each, 100 R. P. M., 26 ft. 0 in. head, in successful operation.



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Type W

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Useful in the Shop and Laboratory for the Measurement of Resistance. Adapted for Fault Locations in Telegraph and Telephone Lines and Cables.

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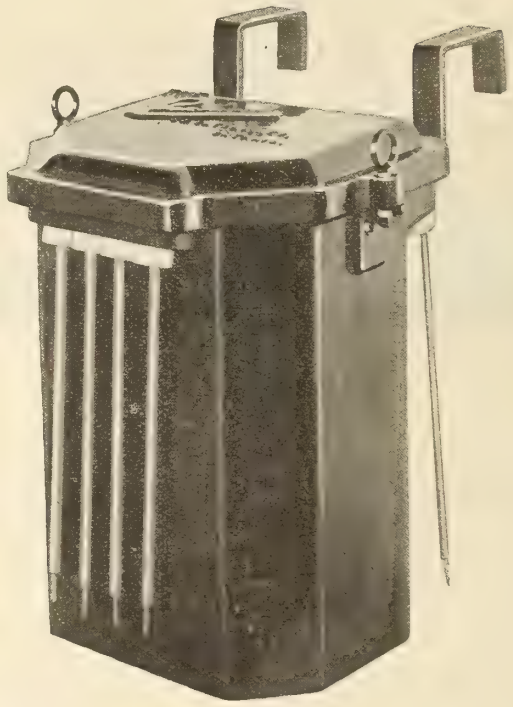
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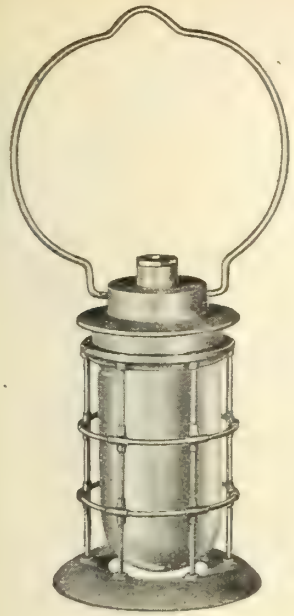
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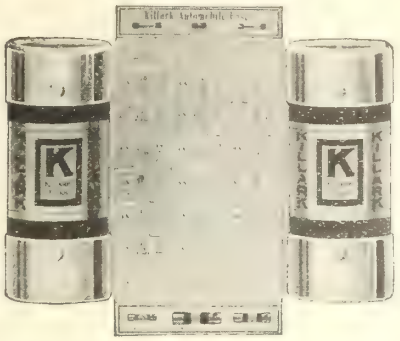
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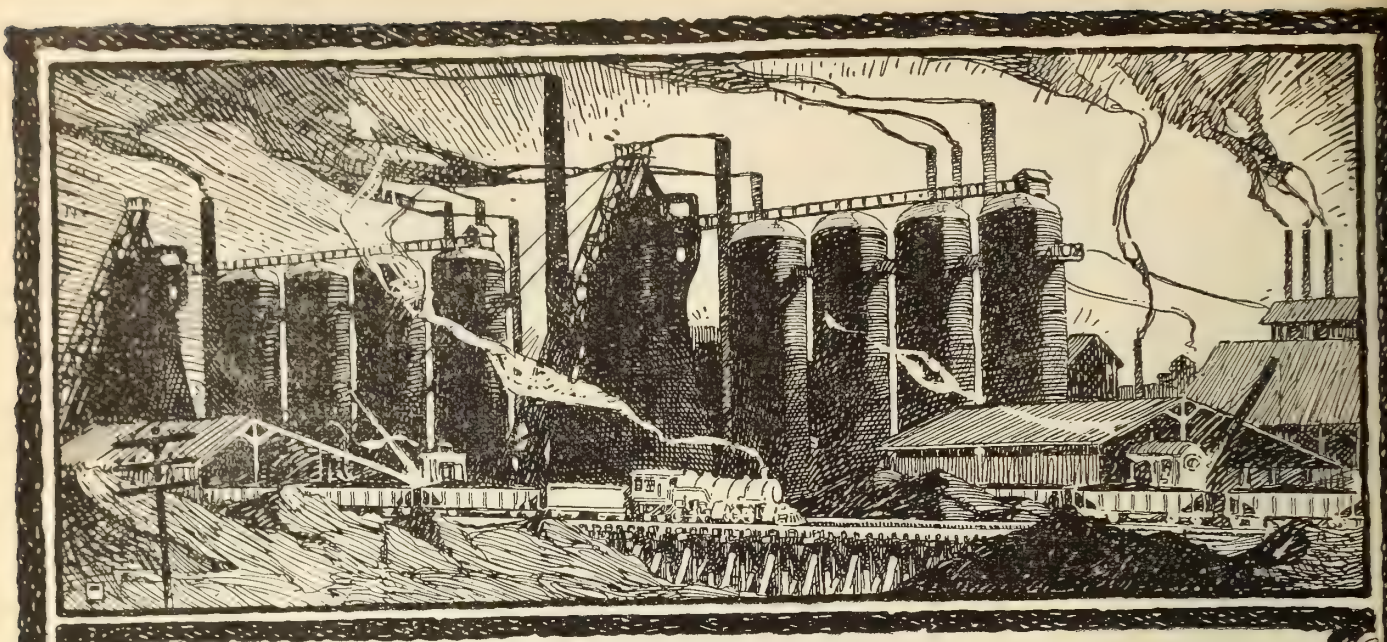
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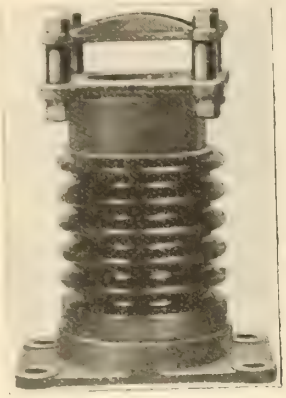
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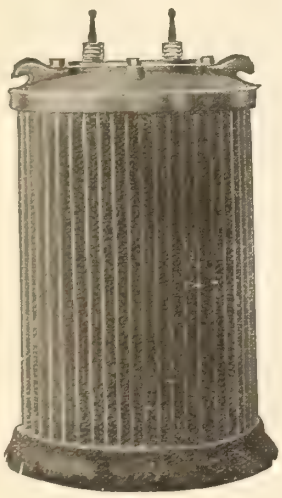
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This is a startling condition.

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"I have no place to attach them," says one.
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What can we do?

How can we remove the obstacles to more revenue, greater sales, greater use of electrical household appliances? The easiest, simplest method of providing an extra outlet, both for emergency and everyday use is the

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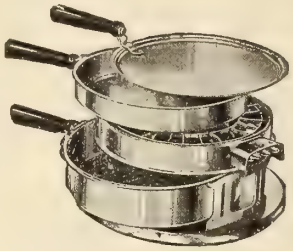
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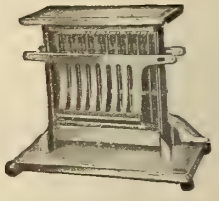
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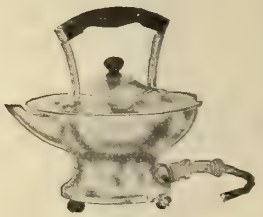
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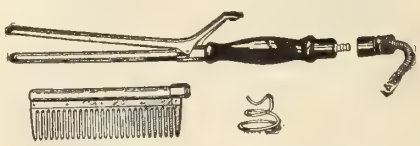
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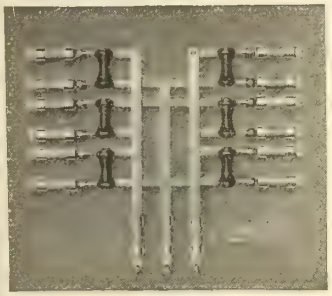
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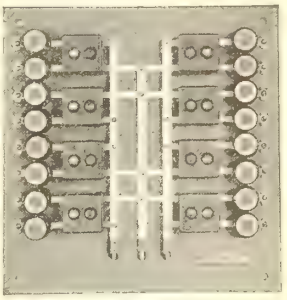
Sprague
PANELBOARDS AND CABINETS



Type CEO.
No. 1. Type CEO.—This panelboard is furnished with either 2 wire or 3 wire mains, having 30 ampere knife switches and N. E. C. enclosed fuses in the branches.

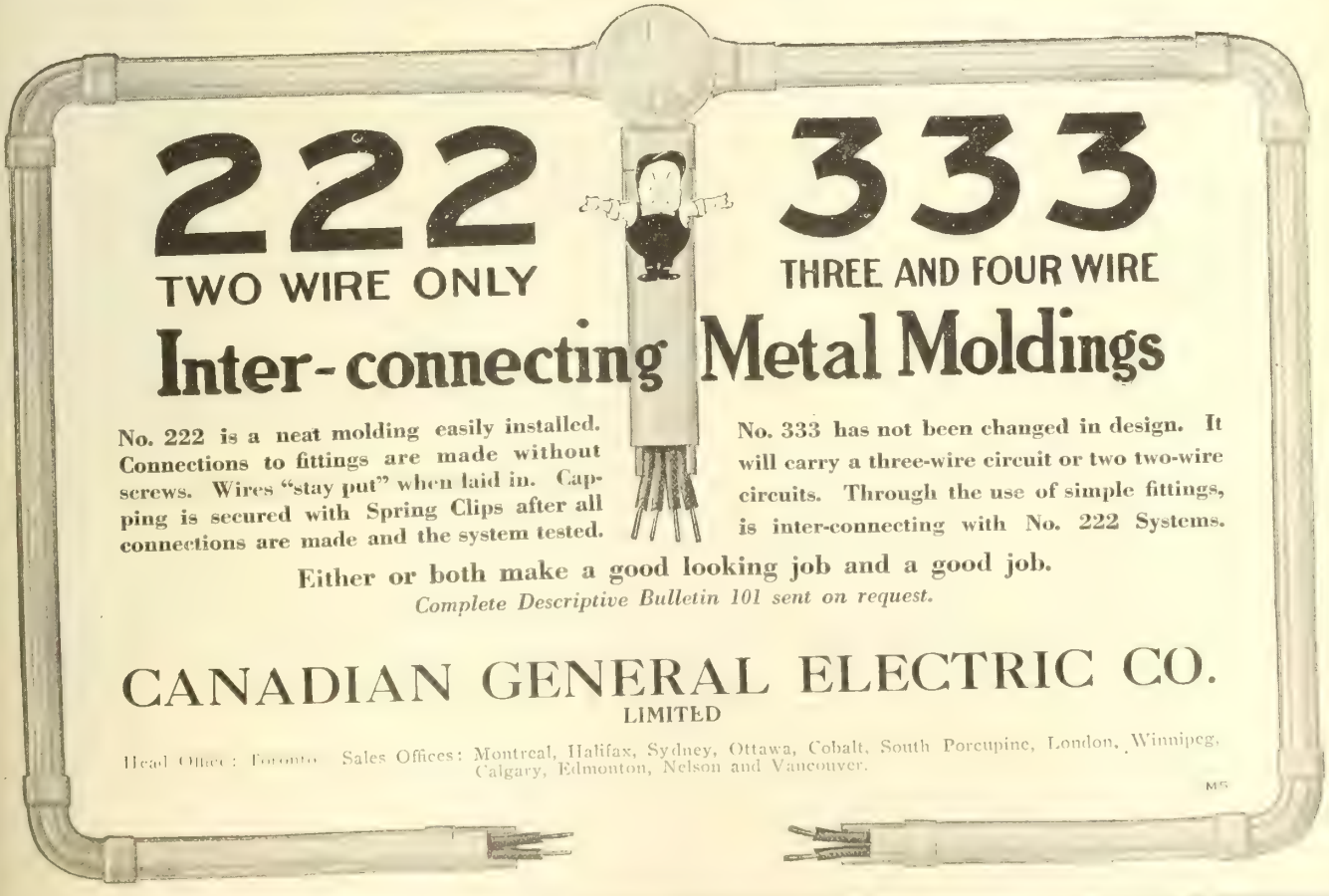
Particular attention is called to the new Sprague "Safety Type" Panels which have been developed to meet the demand for a high grade dead front Panelboard providing absolute safety even to the most careless operator. In this Panelboard the switches, either of the pushbutton or rotary type, are grouped closely together and occupy a small space in the centre of the Panel, protected by a cover furnished with a spring catch.

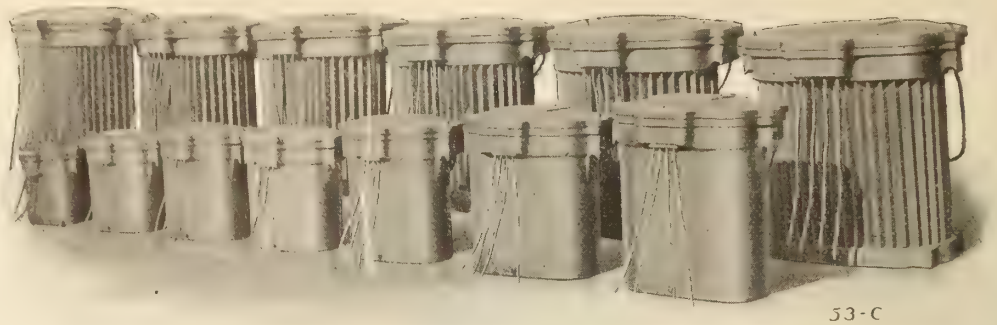
Access to these switches is obtained by opening a smaller door which is hinged on the large door of the Cabinet. By this arrangement any person may have access to the dead front switch compartment, but access to the compartment containing fuses and other current carrying parts is confined to persons entrusted with key to locked door covering this compartment. All parts subject to wear are removable from front of panel and can be replaced without adjustment.



Type PPO.
Fig. No. 2. Type PPO.—This panelboard is furnished with either 2 wire or 3 wire mains having 10 ampere push button switches enclosed in composition covers and plug fuse receptacles in the branches.

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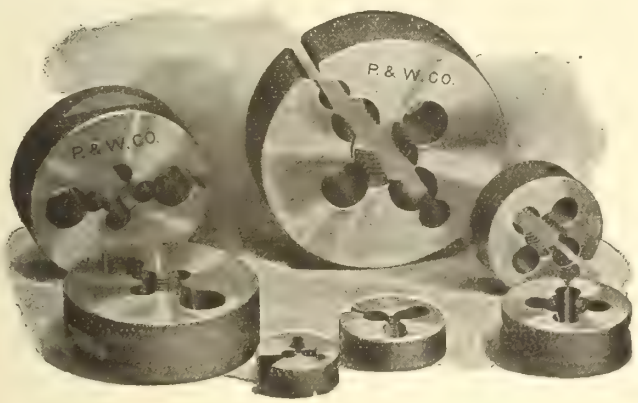
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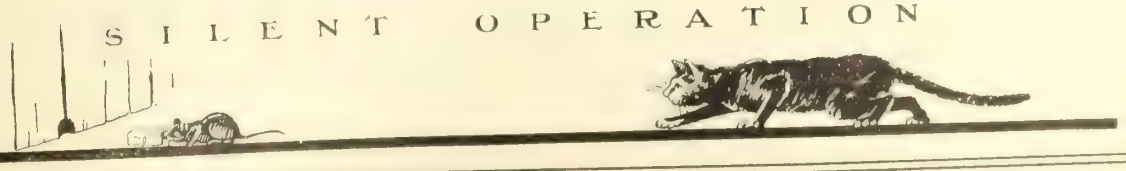
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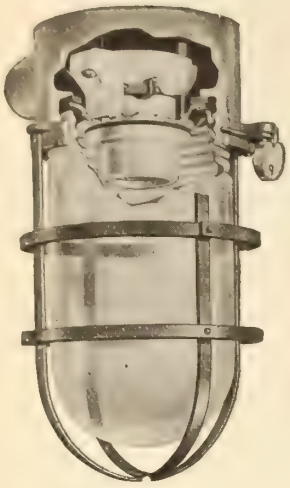
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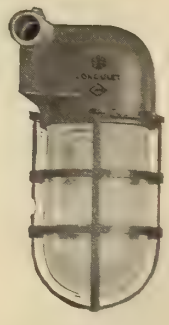
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Vol. 27 Toronto, June 1, 1918 No. 11

Water Powers Should Be Developed Without Delay

Recently the Commission of Conservation placed itself on record "as being opposed to the granting of permits to private interests to develop water power on the St. Lawrence River. In its opinion these powers should be developed by an International Commission, which would utilize the maximum amount of power in the most economical manner possible, and make it available to the neighboring and tributary population of Canada and the United States upon fair and equitable terms."

There can be no quarrel with this suggestion of an International Commission to control the waterfalls of the St. Lawrence or any other boundary river, and another Commission, working in sympathy with it, to control inland water powers. It is not so evident, however, that the word "developed" is the happiest that could have been chosen. It smacks not only of government control—which is right—but also of government development and operation, which, as we have learned in Canada, is not always so desirable. The function of an International Commission should be that of an organizer, not an operator. Its business it should be to see to it that the power is developed—developed economically and keeping the needs of the future, as well as the present, in view; that the power is distributed where it rightly belongs and where it will do us, as a nation, the most good; and finally, that this power should be utilized economically and in such a way as to ensure greatest commercial development to Canada at large. The working out of these plans in detail, however, is scarcely the work of this Commission. The building of plants is a problem for engineers; also their operation; also the utilization of the power in developing industries. It also remains to be proven yet that such undertakings do not thrive best under private management—not private management with unbridled license or franchises that make the undertaking a financial gamble, but under proper control such as is easily feasible and, after the experiences of the past few years, readily acceptable to all parties.

By all means let us have such a Commission and set them to work without a moment's delay. Let it be composed of men who are acknowledged administrators, men with a vision of Canada's future, men who have no desire to tie themselves down with the petty details of development and application of electricity, but who will know how to pick men to attend to these details. There does not seem to be the slightest doubt that Canada can use her water powers as rapidly as they can be developed. Irrespective of the duration of the war, power will be in demand in rapidly increasing quantity. If the United States will co-operate—and why should they not—why not get this Commission in action without further loss and delay?

The Electric Fan A Year-round Utility

The value of the electric fan in summer is generally recognized, but its winter use is very far from general. This is largely, we believe, because its value is not recognized by the average householder. The latest developments in medical science seem to point to the value of keeping the atmosphere in which we live constantly in motion, and a stagnant atmosphere, we are told, is the cause of unhealthy and poor working conditions, much more than the presence of carbon-dioxide or any other poisonous gas in the air. If this is so, the electric fan should be found in every room where human beings congregate and endeavor to use their brains.

The writer of an interesting article in the Electrical World, Mr. Charles Catlett, emphasizes another point in connection with the use of the fan which is very slightly appreciated—that is, that the temperature of the upper part of the average living room is very many degrees higher than the temperature of the lower strata of air. In a general way we have all realized this fact in that it is usually our lower extremities that bother us most when the temperature of a room falls below normal. Mr. Catlett quotes temperature figures to show that in a room approximately 10 feet high, when the temperature at the ceiling is 83 degrees F., the temperature at the floor may be as low as 62 degrees F. His tests showed that at the time there was a sufficient quantity of heat in the room to render the whole area approximately 74 degrees, which is considerably in excess of what most people consider necessary or desirable. The trouble, as he says, is that if a person were sitting down in this room his feet would be at a temperature of about 62-63 degrees; the centre of his body about 67 degrees, and his head slightly above 70 degrees. If he stood up his head would be about 75-76 degrees. Further, the space above his head, which is ordinarily three to four feet, would be considerably above normal temperature, and yet the heat in this area is performing no useful purpose whatever.

Temperature Figures at Various Heights

Height.	Temperature.	Height.	Temperature.
124	83	14	74
108	80	31	68
93	80	4	66
64	76	0	62

There can be no question but that an electric fan, or some other means of agitating and mixing the air, would be of the greatest service under these conditions. A tem-

perature which appears to the occupant to be around 62 to 65 degrees can be changed to 70 degrees or more by the use of an electric fan. The economy in coal is self-evident. In addition we should be following the medical practitioner's admonition to keep the air in the room well mixed. As a combination solution for purifying a stagnant atmosphere and conserving coal, the electric fan seems to give the greatest promise. If these important items were brought to the attention of the average consumer the use of fans would doubtless become much more general.

It is true that these are times when electric current must also be conserved and at certain points in Canada no effort is being made at the moment to sell current-consuming devices. The fan, however, might well be taken as an exception on account of its almost insignificant current consumption. Its more general use would appear to represent the greatest amount of good with the least amount of expenditure of essential energy.

The Electric Club of Toronto Closes Successful Year

The Electric Club of Toronto brought to a close a most successful season on Friday, May 10, when the regular annual meeting was held for the purpose of electing officers, revising by-laws, etc. Mr. Frank T. Groome, president for the past year, received a very cordial reception after his past illness and showed that he had lost none of his former optimism and vigor. The Club, under Mr. Groome's presidency, has made a splendid record and has established itself as one of the essential institutions of the city of Toronto.

During the year the members have met every Friday at noon to lunch together and listen to addresses by prominent men of the city and elsewhere. In the choice of speakers the committee having this matter in hand have been particularly fortunate, in that they were able in every case to get men of outstanding ability in their particular line. A list of the various speakers is given herewith in the approximate order in which they were the guests of the Club:

Rev. Father L. Minehan—"The Irishman Outside Ireland."

Sir Robert Falconer—"The University and the War."

Harbor Inspection—At the invitation of Mr. E. L. Cousins, general manager and chief engineer.

Hon. Mr. Justice Sutherland (Late Speaker, House of Commons)—"Professions."

Frank Stockdale—Advertising.

Arthur Hawkes—"Relations between Ontario and Quebec."

Jos. E. Atkinson (President Star Publishing Company)—"After the War—Industrial Changes."

Prof. H. E. Haultain—"Vocational Training of Returned Soldiers under the Military Hospitals Commission."

Prof. A. P. Coleman—"Recent Visit to South America."

Mr. E. N. Hyde (Montreal)—"Illumination."

Mr. Z. A. Lash, K.C.—"Courts of Law and Equity in Canada."

Major Robert F. Massie, D.S.O.—"The Canadian Attacks upon and Capture of, Passchendaele."

Mr. M. A. Sorsoleil (Principal Normal Model School)—"The Rise and Fall of Germany."

Col. Geo. G. Nasmith, Ph.D., C.M.G., "Keeping the British Soldier Fit."

Prof. Alfred Baker—"Need we fear the financial strain of the War?"

Col. Gordon Morrison—Some Front Line Experiences.

Mr. Arthur V. White—Our International Waterways.

Prof. G. M. Wrong—"Some Aspects of the German Constitution."

Prof. J. C. Fields—"Industrial Research Work in Some of the Best United States Laboratories."

Mr. H. MacDonald (Canadian Manufacturers' Association)—"True and False Advertising."

Prof. St. Elme de Champ——"Alsace-Lorraine."

Lieut. R. W. Harris—"Military Mining."

Lieut.-Col. Cecil G. Williams—"The Empire's Navy, Its Growth and Problems."

Mr. McGregor Young, K.C.—"Future of International Law."

Principal W. L. Grant (Upper Canada College)—"Some Educational Experiments."

Rev. Prof. J. H. Michael—"Lloyd George."

The treasurer reported that the fee of $1.00 did not allow a sufficient margin for necessary expenditures in connection with the weekly meetings of the club and a motion was carried making the membership fee $2.00 for the coming season.

The election of officers for next year resulted as follows:—President, K. J. Dunstan, manager Bell Telephone Co.; vice-president, D. H. McDougall, manager Toronto Electric Light Co.; secretary, Frank Kennedy, Toronto manager Bell Telephone Co.; treasurer, H. D. Burnett, engineer Canadian General Electric Co.; with the following committee: H. H. Couzens, general manager Toronto Hydro-electric System; R. T. Jeffrey, engineer Hydro-electric Power Commission of Ontario; R. D. Perry, general manager Great North Western Telegraph Co.; L. C. Horner, manager Supply Department, Canadian General Electric Co.; Geo. D. Leacock, sales manager Moloney Electric Co. of Canada; W. R. Ostrom, sales manager Northern Electric Co.; C. H. Hopper, Canadian Westinghouse Co.; Geo. Paton, general manager C. P. R. Telegraph Co.; Walter R. Carr.

Professor Evans on "Chemical Research" Before Montreal Luncheon Club

The members of the Montreal Electrical Luncheon concluded a very successful season on May 15th, when Professor N. N. Evans, of McGill University, spoke on "Chemical Research," particularly in relation to the war, and on the imperative necessity of general and technical education in competing for the world's trade.

Prior to the talk, Mr. T. H. Chennell, the secretary, submitted the second annual report of the luncheon, which was inaugurated in February, 1916. From a beginning of seven members, the roll, he said, had now attained a list of 293. The average attendance of the season was 58, the highest attendance being 118. Out-of-town guests numbered 99. Twenty-eight meetings were held during the season. No membership fee was charged, and in order to meet the expenses $77.25 was collected, and $95 contributed by companies when employees attended the luncheon. With other contributions, the total income was $179.22, while the expenses were $168.70, leaving a balance of $10.52. The report also expressed appreciation of the action of the newspapers and magazines in publishing reports of the proceedings.

On the motion of Mr. Randall, seconded by Mr. Wood, the report was adopted, Mr. E. N. Hyde suggesting that the Electrical News be included in the magazines referred to, adding that the reports of the Electrical News had been very accurate.

A vote of thanks was passed to Mr. Chennell, Mr. W. H. Winter, who presided, stated that Mr. Chennell had done splendid and enthusiastic work for the luncheons. In the fall the members would have to consider the question of reorganizing the luncheons, which were now carried on without a permanent organization. Montreal had given Toronto the lead in the matter of luncheons, and he understood that Toronto had now a particularly live association.

Professor Evans, in the course of his speech, referred to

the chemical research which had been the direct outcome of the war. Prior to the conflict Canada had depended for many chemical commodities upon Germany, and the war had naturally cut off these supplies. The country had therefore to set to work to produce these commodities for ourselves. Chemists had a long way to catch up, as the Germans had taken a strong lead, and many people were obsessed with the idea that Germany was capable of doing things which this country was not able to do. But there were others who did not hold this belief, and it was wonderful what had been accomplished in a very short time.

Prof. Evans then sketched the results which had been the outcome of research work. He instanced the manufacture of optical glass in the United States, which had formerly depended upon Germany for the supplies of this glass. It had been found necessary to discover sources of raw materials, the most suitable sand for the purpose being previously obtained from Belgium. A long series of experiments were undertaken, with the result that the United States were producing excellent glass in many varieties which was as good as that formerly imported. Just outside Washington there were about 500 chemists working on the subject of poisonous gases. Prof. Evans mentioned that mustard gas was discovered by a German, and the United States were now manufacturing this gas and sending it in large quantities to the nation which discovered it. These chemists were also at work on the subject of discovering antidotes to poisonous gases.

In connection with munitions, a large amount of chemical research had been carried out. At McGill University experiments had been made on t.n.t., particularly in relation to the solubility of the liquor in which it was produced, and how to conserve that liquor; also as to purifying the materials and making them stable. Considerable work had been done in connection with steel.

With regard to acetone, they all knew what large quantities were being produced by the Electro-Products Company at Shawinigan Falls. In fact the development in connection with the production of acetone was one of the most wonderful things in connection with the war.

Referring to potash and its use as a fertilizer, the speaker stated that formerly the main supply came from Germany. There were immense supplies of potash in Canada, but unfortunately no method has yet been found by which it could be economically produced from the rock. On the subject of nitrogen, Prof. Evans spoke of the success of electrical fixation in Norway and Sweden. The Germans, too, were producing nitric acid from the air, and he had been informed that the United States were just as successful as Germany in obtaining nitric acid by the fixation process.

It had been asked why Germany had gone so far ahead in chemical research. One reason was the Gearmans were a people of wonderful patience. In Europe the people stuck to a business from generation to generation, while on this continent they jumped from one business to another. Another reason for the progress in Germany was the thoroughness of ordinary and technical education. One could not have research work unless it were built on something, and that something was education. Canadians would have to submit to that spirit of thoroughness if they were to successfully compete for business. It was of the utmost importance that our people should know more than one language. We ought to concentrate upon our work. These were some of the reasons why we had fallen behind, at any rate so far as chemistry was concerned. There had been much discussion as to imposing heavy tariffs, but in his opinion if we were to keep our trade, there was only one way to do it, and that was by making goods as well and as cheaply as other countries; otherwise we would not keep the business.

Votes of thanks were passed to Mr. Winter, the chairman of the luncheons, and Mr. E. N. Hyde, chairman of the papers committee. In reply Mr. Winter said he believed there was an important future for the luncheons, and he was looking forward to a permanent organization which would bring larger developments.

Commission of Conservation Issue Ninth Annual Report

The Ninth Annual Report of the Commission of Conservation is out and contains, as usual, a quantity of useful and interesting information regarding Canada's resources. It is in effect a report of last November's annual meeting, and contains the papers read and reports presented at that time. The papers include discussions on such topics as "Peat," by Eugene Haanel; "Fuel Situation," by C. A. Magrath; "Power Possibilities on the St. Lawrence," and "Niagara Power Shortage," by A. V. White; "Electrification of Railways," by S. T. Dodd. The papers have already been treated in more or less detail in previous issues of the Electrical News. A brief report by Mr. Leo G. Denis, however, had not previously been published and it is of interest as outlining in some detail the work the Commission has under way. Mr. Denis' report is, therefore, printed in part below:

Waters and Water-Powers

Special efforts were made during the past year to secure descriptive information on electric power plants and systems throughout the Dominion for a report to be published shortly on the supply and distribution of electric energy in Canada. The importance of this subject as related to our water-power resources need scarcely be enlarged upon. Without the impulse given by the possibility of transmitting power over long distances, water-powers would not have attained the high place they now occupy among the various natural resources of a country. Long distance transmission of energy is only possible through the medium of electricity and, while some large developments, notably in the paper and pulp industry, make direct use of water-power, practically all other developments of importance are for the production of electrical energy.

The report will give a short description of all electric central station systems, including power plants, transmission lines and distribution, each system being described individually. In previous reports respecting this subject, the Canadian data have been appended to United States reports and treated as secondary. Their incompleteness has created a false impression to the detriment of this country. This is simply due to the fact that complete information covering the Dominion has not, thus far, been collected. The production of electric energy in Canada is one of the developments to which we can point with pride and the data thus far received demonstrates that, in this respect, we are behind very few countries, if any.

The greater portion of the information has been collected by correspondence, under the direction of your Water-power Engineer and your Mining Engineer. The various questionnaires sent out in this connection included the following items:

Hydraulic Plants.—Dams and hydraulic works; available head, flow of river, hydraulic troubles, power houses, turbines, generators and transformers, demand and output, interruptions to service, costs and date of installation.

Steam and Internal Combustion Engine Plants.—Power houses, boilers, gas producers, engines and turbines, generators, fuel, costs and date of installation.

Transmission Lines.—Location, voltage, capacity, construction, protection and sub-stations.

Distribution.—Purchased energy, station transformers

output, mileage of streets covered, voltages, line transformers, connected load, street lighting, costs and rates charged.

Another subject receiving attention is the revision of the list of developed water-powers in Canada as published in the report of 1911. The developed water-powers are increasing in number and, as no detailed complete information has been published since the report above referred to, it seems most desirable to have the data brought up to date. The Commission is constantly receiving inquiries on various phases of this subject. From time to time, estimates of developed water-powers for the whole Dominion or for certain portions of it have been made but these are of little value unless specific information respecting each power included in the estimates is given. The publication of a detailed list also permits any grouping which may seem desirable.

Routine work included the preparation of a number of short articles having reference to our water-power resources and also brief reports on special subjects, including possibilities of water-power sites, rates for electric energy, data on discharges of rivers, industrial statistics, certain water-powers of the Prairie Provinces, bibliography of Canadian water-powers, general water-power situation in Canada, water filtration plants in Canada, and electric energy required for various purposes.

Coteau Dam Project

A report was prepared on the proposed scheme to dam the River St. Lawrence for the development of power at the Coteau Rapid at the foot of Lake St. Francis. Apparently, the principal object of the project is the exportation of electric energy from Canadian water-power. Permission for such a development would be in violation of the recognized principle that no further development should be allowed on the St. Lawrence between Prescott and Montreal until a comprehensive plan of development for that portion of the river has been decided upon. The necessity of this is emphasized by the conditions at Niagara. There, the development by the Ontario Hydro-electric Power Commission will utilize the entire head, including the lower rapids, instead of being limited to the descent in the cataract proper, as has been the case with all the power so far developed. It is also proposed to "scrap" some or all of the existing plant which, if carried out, will involve the destruction of many millions of invested capital.

Champlain Dry Dock, Quebec, Electrically Operated Throughout

In a paper on the Champlain drydock for Quebec harbor, read at the Canadian Society of Civil Engineers, Montreal, Mr. U. Valiquet, M.Can.Soc.C.E., superintending engineer, Department of Public Works, briefly described the electrical equipment for the working of the dock. He stated that three main centrifugal pumps, each of 63,000 gallons per minute capacity, are used to empty the dock; two pumps of 6,000 gallons per minute each are used to keep the dock dry. All pumps are run by electric power. Eight boilers, of a total capacity of 3,600 horse-power furnish the steam at 200 pounds pressure to run the three direct current turbo-generators of 1,500, 750, and 300 kilowatts respectively, which furnish the current at 550 volts to run the pump and other motors.

A direct current generator of 100 kilowatts, at 220 volts, driven by a steam engine, will furnish the current for the lamps around the dock and in the buildings. There are 24 lamps of 500 watts, hung from poles around the dock. The poles are made of gas pipe, with the lower end set into sockets fitted with electric connections and made removable in case of necessity. All electric wiring for lamps and motors outside of the buildings is placed underground.

There are nine electrically-driven capstans, with 15 h.p. motors, four on each side of the dock and one at the head. The rolling caisson is provided with six culverts, 42 inches in diameter, closed by sluice valves that are operated from the upper deck by a 15-horse-power electric motor, driving a longitudinal shaft, provided with the necessary gearing; and, by means of clutches, any one or all of the valves may be worked. The culverts are used for flooding the dock.

Six water tube boilers of 500-horse-power and two of 300-horse-power furnish steam at 200 pounds pressure to produce electric current. The boilers are provided with automatic stokers, ash and coal conveyors. The coal is unloaded from cars into a coal crusher run by an electric motor and elevated to a hopper of 500 tons capacity, over the front of the boilers. Water heaters are provided, but the steam is not superheated; one of the small boilers will be constantly under steam pressure to run the drainage pumps and the lighting dynamo

The electric power consists of three direct current turbo-generators of 550 volts, one of 1,500 kilowatts, one of 750, and one of 300 kilowatts. The steam turbines are of the Curtis condensing type, built by the General Electric Company. In the large unit the turbine runs at 3,600 r.p.m. It is geared down to 360 revolutions for the generator; the second is geared from 5,000 to 750; the third is geared from 5,000 to 900 r.p.m. A 100-kilowatt generator, driven by a high-speed, direct-connected engine, furnishes the current for lighting purposes.

This power installation is more than ample for all the machinery connected with running of the dock proper. It is, however, anticipated that the whole of it will be used when large repairing and shipbuilding shops are in operation, together with the pumping of the deck.

This electric installation has been criticized on the ground that the large expenditure is not justified when electric current is available from private companies in the vicinity of Quebec. When the electric installation was proposed by the writer the idea in view was that no company would be interested or willing to furnish over 3,000 h.p. at any time of the day or night for the short period of about 50 hours in the year without interfering seriously with their general service. It had also been ascertained by personal visits to five of the principal navy yards of the United States Government that each of them has provided its own electric power for pumping their drydocks. Out of five, only one had installed alternating current machinery. It has developed since that the only electric company that could furnish the power current is not willing to entertain the proposition unless at a much greater cost to the government than the private installation can be run, including the interest on the outlay, which is approximately $240,000.

The dock is emptied by three main pumps of the horizontal centrifugal type, each having a capacity of 63,000 gallons per minute. The bronze shafts are connected to the armature shafts of 800-horse-power motors, running at 750 revolutions per minute. The motors are built to stand an overload of 25 per cent. for two hours; the total lift will very rarely be more than 33 feet. The suction and discharge pipes are 48 inches; the water is discharged into a chamber provided with non-return valves, and to a culvert through the entrance wall outside of the caisson. The main pumps are guaranteed by the builders to deliver 63,000 gallons per minute against a total head of 25 feet.

Two auxiliary pumps each of 6,000 gallons per minute capacity, driven by electric motors of 125-horse-power, will take care of leakages and seepage. These pumps will also help while the dock is being pumped. The pumps were manufactured by the Allis-Chalmers Company.

The time occupied in emptying the dock will vary according to the height of tide when the pumps are started and the size of the vessel being docked. At high water of spring tides the dock contains over 38,000,000 gallons of water This

quantity of water, however, will very rarely, if ever, exist when pumping is started. It is estimated that the average time for pumping out the dock will be about two and a half hours.

The power-house is 120 x 100 feet, divided by a brick wall into two rooms, 120 x 50 feet, one being the boiler-room and the other the generator-room. The walls are solid brick, built on concrete foundation; the roof is built of reinforced concrete slabs, supported by steel I-beams, which were procured from the unused steel of the first Quebec Bridge. The building is provided wih extra large windows, with steel frames Skylights and ventilators are also provided. The floor is concrete overlaid with red tiles; and the lower part of the interior walls for the generator-room is finished with a white tile wainscoting 6 feet high. The generator-room has an overhead travelling crane of 15 tons capacity. The lifting is done by motor; the travelling gear is worked by hand.

Cos Figures on Generating Station $70 per Kw. for Completed Plant

It is always difficult to get accurate construction figures on electrical installation work, and for that reason a short article appearing in a recent issue of the Electrical World, giving the itemized cost of construction of a Massachusetts central station, is of timely interest. The cost includes the building, which is designed for one 500 kw. and two 2,000 kw. turbo-generators. Only the 500 kw. and one of the 2,000 kw. generators is installed and included in the cost, which covers building, boiler, coal handling and piping installations adequate for the completed 5,500 kw. The total cost of the plant is $269,000 and it is estimated the second 2,000 kw. unit can be installed for about $40,000, a total of $309,000, or about $70 per kw. The itemized cost of the plant, as at present built to 2,500 kw. capacity, is as follows:

Land

Land	$25,000	
Docks, walls and filling	4,271	
Legal expenses for do	348	
Surveying for do	43	
Dredging and intake	3,035	
		$32,697
Preliminary engineering investigation		7,000

Building

Sub-surface foundations	$9,040	
Steel for station building	18,080	
Superstructure	27,641	
Stack, 200 ft. high, 9 in. inside diameter	6,954	
Steam heating	772	
		62,851

Service Equipment

Coal and ash handling	$11,594	
Coal and ash bunkers	3,063	
Water supply and storage	353	
Oil filters and storage	48	
Crane	1,588	
		16,646

Boiler Plant

Four 342-h.p. B. & W. boilers with superheaters and settings	$24,074	
Four Taylor underfeed stokers and drive	8,664	
Flues and air ducts	459	
Pumps—turbine-driven duplicate set	2,597	
Blowers—turbine-driven duplicate set	1,674	
Feed-water heater (1500 b.h.p.)	866	
Instruments and regulators	1,092	
		39,426

Piping for 4500-kw. Rating

High-pressure steam piping, steel valves and fittings	$4,222	
Exhaust steam piping, valves, fittings, etc.	2,278	
Water and oil piping	1,304	
Condenser piping, outside building	9,337	
		17,141

Turbo-Generator Plant, 2000-kw. Unit

(500-kw. unit from old station, see later section)

Turbo-generator, 2000-kw. rating, 80 per cent. power factor	$22,904	
Surface condenser, 3,500 square feet	9,054	
Condenser piping, inside	1,423	
Air supply and cleaning	935	
		34,315

Switchboard and Electrical Equipment

Switchboard, oil switches, instruments, etc.	$12,567	
Exciter and 100-kv.a. auxiliary three-phase transformer	2,393	
Municipal station apparatus	21	
Station wiring	1,075	
Connections to overhead lines	5,400	
		21,456

Miscellaneous

Interest during construction	$3,706	
Fire insurance	680	
Liability insurance	162	
Steam coal used during building and in tests	1,031	
Miscellaneous material, apparatus, tools, hardware, etc.	1,569	
Unclassified labor, watchmen, foremen, etc.	1,817	
General expenses, unclassified	410	
		9,375

Engineering

Engineering architect	$6,300	
Field supervision	2,860	
Drafting and blueprinting	1,858	
Drafting and office expense	259	
		11,277

500-kw. Turbine Transferred from Former Station

Turbo-alternator, 500-kw.	$10,000	
Piping for turbine	2,752	
Wheeler condenser (second-hand)	1,000	
Air and circulating pump	1,435	
20-h.p. Terry steam turbine	425	
25-kw. direct-current motor-generator exciter set	1,220	
Instruments	85	
		16,917
Total		$269,101

The Alberta Hydro-Electric Company Planning a Series of Six Developments

The Alberta Hydro-electric Company, Limited, Calgary, recently called tenders on the construction of a series of dams and hydro-electric developments in connection with some half-dozen water falls in the immediate vicinity of the city of Calgary. The total fall in the Bow River at this point, over a distance of 10½ miles measured along the river, is 120 feet. This is divided approximately into six falls, two of which are located within the city limits. Roughly the heads and capacities of these various falls are as follows, it being estimated that the flow of water is 2,000 c.f.s.:

No. 1—head 21 feet, maximum development	3,818 h.p.
No. 2—head 20 feet, maximum development	3,636 h.p.
No. 3—head 12 feet, maximum development	2,181 h.p.
No. 4—head 17 feet, maximum development	3,091 h.p.
No. 5—head 12 feet, maximum development	2,182 h.p.
No. 6—head 17.5 ft., maximum development	3,182 h.p.
Total development	18,090 h.p.

The above information has been supplied to us by Mr. Zeph. Malhiot, vice-president and manager of the company, who advises that the reason for the series of dams, rather than one or two large ones, is that this plan will obviate the inundation of certain city areas. The calling of tenders is not to be interpreted that the plan will be carried out immediately. The question at the present time is one of financing. Calgary needs the power but the problem of securing capital for new projects is no more easily solved in that city than elsewhere.

Transmission Line Practice—Modern Systems—Article VI.

By Lieut. E. T. Driver and E. V. Pannell

It is interesting after studying some of the factors of transmission line design to review briefly some of the more important and extensive installations in different parts of the world to see how far actual practice is consistent with the theories outlined. A brief survey has been made of a few modern transmission lines in the United States, Mexico, India, South Africa, New Zealand, Japan, and Germany. Beginning with American practice, one of the most important systems is that of the

Mississippi River Power Company

The Mississippi River Power Company, generating power at a 30 ft. head on the Mississippi River, near Keokuk, Ia., and transmitting at 110,000 volts, 25 cycles, to St. Louis, Mo., 144 miles away. As with all transmission systems, there are branch lines to different distributing points, but the main interest centres in the trunk lines to St. Louis. Conductors are copper, 300,000 c.m. in size, strung on spans of 800 ft. standard length; this long span is one of the remarkable features of the line. Ten years ago the average span of tower lines was about 500 feet, and curves showing the most economical span length generally have their minimum point at about 600 feet. The advantage of longer spans than this is that the number of insulators is still further reduced, and the right of way charges are also probably lower.

Over each of the two circuits about 34,000 kva. is transmitted, a total which, considered with the long spans and river crossings, the large size of conductors, and the very tall towers, renders the Mississippi transmission line almost unique for the boldness with which it has been engineered. The maximum power of any long distance transmission line is probably conveyed by the Cedars Rapids Manufacturing and Power Company, along the double circuit line from Cedars Rapids to Massena, N.Y.

Cedars Rapids Line

A total of about 40,000 kva. per circuit is carried a distance of 60 miles to the electro-chemical factories at Massena at 110,000 volts, 60 cycles. The conductors are aluminium-steel, 500,000 c.m., carried on double-circuit towers, with a span of 660 feet. This combination probably calls for the heaviest standard tower in general use, the average weight of these structures being 7,000 pounds. There are three general types of tower in use; suspension towers are designed to stand with two conductors broken on one side and maximum wind and ice loads. Anchor towers are designed for the same stress, but are equipped with strain insulators. Dead-end and corner towers are designed to stand with all conductors broken and maximum wind and ice conditions. Since the elastic limit on this size of aluminum-steel cable is 12,000 pounds, the failure of six cables leads to the enormous unbalanced pull of nearly 72,000 pounds on the dead-end tower. Such a failure is in the last degree improbable with these steel core cables. Nevertheless, it forms the basis for the tower design, and, with the liberal factor of safety, this is the most heavily-constructed long-distance transmission line in existence. In more southerly latitudes it will be seen that construction is much less rugged, because the absence of sleet involves lower stresses and tower loads. A typical modern southern transmission undertaking is that of the

Tennessee Power Company

From Cleveland, in the Cumberland Mountains, to Nashville City, is 140 miles. Power is generated at a 250-foot head and transmitted at 120,000 volts, 60 cycles, the kva. per circuit being about 20,000. The greater part of the line is constructed with two single-circuit tower lines, having the conductors hung in the horizontal plane. The conductors are 2/0 B & S copper, and the spans 660 feet.

The adoption of the two separate circuits is a valuable factor in reliability. In the first place, the spacing can be more liberal, thus quite eliminating corona loss and short circuits due to sleet jump. The greater spacing frequently permits a longer span being run. Furthermore, the design of tower is very compact; it has no great length of cross-arm, and its height is at least 20 feet less than that of the equivalent twin circuit tower. The disadvantages lie in the extra cost of right of way and the higher costs of construction. However, where maximum possible reliability is to be secured it is probable that two separate tower lines will in future be adopted. The same practice is adopted upon the highest voltage transmission line at present in operation, that of the

Pacific Light and Power Corporation

This line supplies the city of Los Angeles from the power station at Big Creek, in the Sierra Nevada, 241 miles away.



Fig. 20. One of the semi-anchor towers, equipped with lock insulators, on the Cedars Rapids Manufacturing and Power Company's transmission line.

The present output per circuit at 150,000 volts, 50 cycles, is 35,000 kv.a., but this is far from being the limit of the development. The conductors are of liberal size, being 605,000 c.m. aluminium-seel, strung on 660-foot spans. The standard one-circuit tower weighs 5,600 pounds. The reason for the somewhat heavy construction lies in the large size of the cables and the high elastic limit. Furthermore, it will be seen that a

single circuit tower should be figured to withstand the failure of two cables, or two-thirds of the conductors on one side; at the same time a double circuit tower is figured for just the same eventuality, which in this case amounts to only one-third of the wires on one side. This is the reason for the single-circuit structure always being a little heavier than might appear necessary in comparison with the twin-circuit type.

Tata Hydro-Electric Company

Turning from American to European practice, it is interesting to survey two modern high-tension transmission lines, designed and constructed by an English firm. The first of these is the Tata Hydro-Electric Company, operating be-

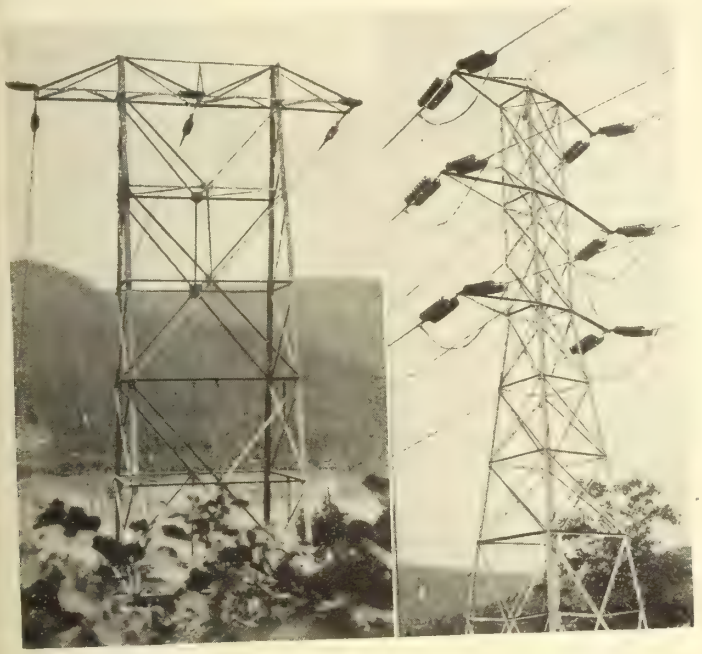


Fig. 21. Heavy river crossing tower, on the Tennessee Power Company. Copper cables strung on Ohio Brass strain insulators.

Fig. 22. Double-circuit anchor tower, on the Tennessee Power transmission line.

tween Khopoli and Bombay, India. Power is generated at a 1,700-foot head in the Western Ghats, and conveyed 43 miles to the city of Bombay, at 100,000 volts, 50 cycles. The voltage has been criticized as being very high for the short distance, but the intention is to extend this system considerably as soon as the load develops. Furthermore, it is believed by some transmission engineers that upon leaving the range of the pin insulator there is no wisdom or economy in operating below the 100 kilovolt figure. The power transmitted per circuit amounts at present to 25,000 kv.a., and the conductors are of seven-strand copper, 121,000 c.m., strung upon spans of 500 feet, with steel towers. The standard tower has a narrow base, but the line is reinforced at intervals with broad base anchor towers. It is interesting to note in comparison with American practice that, instead of being built up with galvanized sections and sherardized bolts, the towers are riveted together on the site and afterwards painted. The standard towers are figured for two conductors failing, and the anchor structures are designed to take care of a failure of all the wires on one side. Loading consists of a wind pressure of 25 pounds per square foot, and the wires are calculated to have a maximum stress of one-fourth the ultimate strength; in other words, the factor of safety is about double that commonly used in America. Several long crossings are encountered, especially on the creeks around Bombay, and the practice is to use a high tensile bronze wire for these spans. Suspension insulators are, of course, used throughout, and are suspended by swing links from the longest cross-arms, so that the unbalanced pull when the wire fails is minimized. This practice would not be possible were the cables not strung well out of the same vertical plane.

Victoria Falls

Another transmission system engineered by the same English firm as the above (Messrs. Bullers, Ltd.) is that of the Victoria Falls and Transvaal Power Company, in South Africa. It links up an extensive group of steam power stations with the Rand mines and other industrial points. Transmission is partly at 40,000 and partly at 80,000 volts. Conductors are of seven-strand copper, 120,000 c.m. in size, there being two double-circuit tower lines for the 80,000 volt transmission. The general design and construction are similar to those of the installation just described, except that the safety factors for towers and cables are five instead of four. In both these examples, it will be noted, there is no necessity to allow for any sleet loading, so the high safety factor does not lead to extremely heavy construction. Every fourth tower is an anchor structure, designed to withstand the failure of all the conductors on one side.

The 80,000-volt transmission extends from Vereeniging to the Rand, 35 miles, and the power transmitted per circuit is 15,000 kv.a. Six-unit suspension insulators are used.

Lauchammer Company, Saxony

The power supply situation in Germany is complicated by the fact that not only are there no easily-developed water-powers in the country, but the coal supply is very poor. During the war these resources have been developed to their utmost, and most of the great nitrate and other electro-chemical works are supplied with steam-generated electric power, transmitted from the mines. Shortly before the war the first undertaking of this kind was put into operation, namely, the system of the Lauchammer Company, Saxony, and it may be assumed that a large number of similar installations of the same kind are now working. The Lauchammer transmission was the first 110,000-volt line in Europe. Power is raised from the low-grade soft coal known as "braunkohl,"

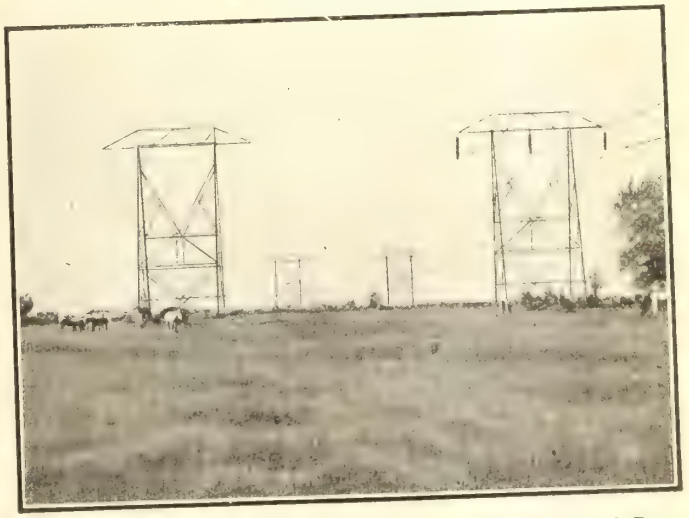


Fig. 23. On the 150-foot right of way of the Pacific Light and Power 150,000-volt lines.

which is consumed at the mine location. To transport this coal it must be compressed into briquettes; it was therefore found to be an economical proceeding to generate electric power and transmit that instead. A double-circuit line conveys the power to Groditz and Riesa a total distance of 34 miles. The voltage is very high in comparison with the length of line, but the reason given by the engineers of the line was that only suspension insulators could be considered, on account of the liability of the pin type to damage due to mischief or other causes. Having adopted suspension units, there was no object in setting a lower voltage than the one chosen. It is, however, more likely that this undertaking was intended as

an experiment, and that the voltage was chosen with a view to systems of much larger extent, such as are now operating.

The frequency is 50 cycles, and about 10,000 kv.a. is carried over each circuit. Wires are of copper, seven strand, 50,000 c.m. in area, strung on narrow base steel double-circuit towers. The standard span is 500 feet, with a long crossing to negotiate the River Elbe of 900 feet. Instead of the usual German practice of using bronze wires for this long span, it was decided to employ copper of 85,000 c.m., strung with a safety factor of five. The spacing between conductors is very short, being only six feet. With this short spacing,

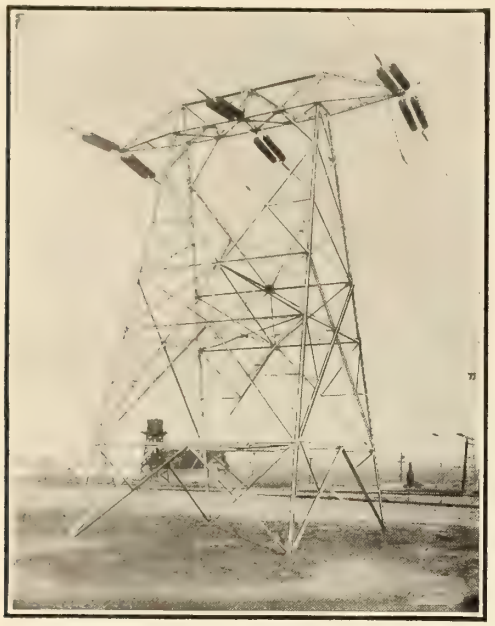


Fig. 24. One of the anchor towers on the lines of the Pacific Light and Power Corporation.

the small wires and the high voltage, it is not surprising that considerable corona losses have been experienced, a factor which was evidently quite overlooked when the lines were designed. As with most European lines, grounding arms are provided on every tower, so that the conductor cannot fail to make contact with one of them if it breaks. Furthermore, conductors are arranged on the equilateral plan, and are transposed six times in the total 35 miles.

Lake Coleridge Development

The Ontario Government is not the only one which has personally supervised and conducted great water-power and transmission developments; similar achievements have been made in New Zealand. The first of the government power undertakings to be put into operation is known as the Lake Coleridge Development. The lake is situated in the Southern Alps of South Island, about 70 miles from Christchurch. About 50,000 kw. is available at this source, but the initial development was for 10,000 kw., which is transmitted by a double-pole line to Christchurch. Another line has also been constructed to the port of Timaru, 100 miles further south. The voltage is 66,000, at 50 cycles.

This is another instance of the construction being modified by special conditions. Owing to the fact that structural steel has all to be imported, a pole line was decided upon for this transmission. Australian ironbark forms a cheap and most durable pole material, and it is employed throughout this system. The voltage used is the highest possible under the limiting features of pole cross-arms and pin insulators; nevertheless, the construction is extremely economical. The two-pole line circuits are carried to their destination by entirely different routes, so that localized lightning disturbances are not likely to affect both circuits. Conductors are aluminium 2/0 B & S, strung with spans of 300 feet, and a spacing of 72 inches.

Inawashiro Hydro-Electric Company

Hydro-electric power is being rapidly developed in Japan, and the most extensive system up to the present is the Inawashiro Hydro-Electric Company. Lake Inawashiro, located 144 miles from Tokio, the commercial capital, provides the reservoir, from which at present 40,000 kv.a. is developed. Transmission is at 115,000 volts, 50 cycles, over a double-circuit steel tower line, the conductors being of copper, seven strand, 200,000 c.m. Whilst it is true that a very large proportion of the electrical plant sold in Japan is of English manufacture, American engineers are responsible for almost every detail of their transmission lines, and the Inawashiro transmission, together with the Katsuragawa and other systems, are very closely in liine with similar installations on this side of the Pacific. There is every indication that the Japanese have gained the experience they required, and they are now rolling structural steel and manufacturing insulators with a view to supplying their own requirements for future transmission line engineering.

SYSTEM	KILO-VOLTS	DISTANCE MILES	KV PER MILE	CONDUCTORS MATERIAL	CONDUCTORS CIRCULAR C.M.	KVA PER CIRCUIT	AMPS. PER SQ. INCH	INSULATORS NO UNITS	INSULATORS KV PER UNIT	SPACING INCHES	SPACING MIN. PER KV
PACIFIC LIGHT & POWER	150	241	.62	AL-STEEL	368 000	30 000	400	9 - 11	16.7-13.6	210	1.40
SOUTHERN SIERRAS POWER	140	238	.59	" "	211000	4200	104	6	23.4	134	.96
COMMONWEALTH POWER	140	245	.57	COPPER	105600	15000	750	10	14.0	144	1.03
UTAH POWER & LIGHT	130	136	.96	"	250000	12000	270	9 - 11	14.5-11.8	156	1.20
TENNESSEE POWER	125	140	.89	"	133100	10000	440	7- 8	18.0-15.6	126	1.01
INAWASHIRO POWER	115	144	.80	"	198000	28000	900	7 - 8	16.4-14.4	120	1.04
PACIFIC GAS & ELECTRIC	110	110	1.00	(ALUMINIUM) (COPPER)	167800	13000	625	7 - 8	15.7-13.7	120	1.09
MISSISSIPPI RIVER POWER	110	144	.76	COPPER	300000	36000	810	7 - 8	15.7-13.7	120	1.09
HYDRO-ELEC. POWER COMM.	110	229	.48	(AL-STEEL) (COPPER)	212000	22000	700	8 -10	13.7-11	128	1.16
CHILE EXPLORATION	110	86	1.28	COPPER	167800	20000	810	4 - 5	27.5-22	155	1.41
ALABAMA POWER	110	150	.73	"	133100	18000	900	6 - 7	18.3-15.7	120	1.09
GEORGIA RY & POWER	110	90	1.22	"	212000	25000	790	5 - 5	22	108	98
CEDARS RAPIDS MFG.	110	70	1.57	AL-STEEL	300000	36000	810	8 - 8	13.8	120	1.09
MEXICAN NORTHERN	110	158	.70	ALUMINIUM	212000	11000	350	7 - 9	15.7-12	120	1.09
SIERRA & SAN FRANCISCO	104	138	.75	COPPER	133100	14000	740	5 - 5	20.8	96	92
GREAT WESTERN POWER	100	154	.65	"	167800	25000	1100	5	20	120	120
TATA HYDROELECTRIC	100	43	2.32	"	121000	20000	1360	6 - 7	16.6-14.3	126	1.26

Fig. 25—Data for modern transmission lines of 100,000 volts and over.

Electrical Systems for Automobiles

Summary of Paper Read by Mr. J. M. F. Wilson, B.Sc. before the Manitoba Branch of the Canadian Society of Civil Engineers

Dealing first with ignition systems, the author pointed to the striking fact that over 70 per cent. of the cars turned out in the United States of America in 1916 and 1917 used a battery and coil system of ignition, in a refined and improved condition, but essentially the same as the first cars put on the market. The magneto had for a time superseded the coil and battery, but the development of starting motors and lighting generators, with the resultant ease of keeping a storage battery in good condition, had brought us back to the first-mentioned system. The remaining 30 per cent. could not be passed over lightly, as it included dual, and where extreme reliability was aimed at, double and triple systems. For the most part these systems were luxuries, or relics of a time when the high tension magneto was not yet accepted without suspicion. The paper aimed at dealing with the improvements only in the modern magneto.

Slides were then shown and described, dealing first with a simple battery system for a one-cylinder motor, the difference between three and four terminal high-tension coils and the action of the condenser being explained. Coming next to four and six-cylinder motors, where a timer on the low-tension side was used, it was necessary to have as many coils as cylinders, hence the introduction of the high-tension distributor and single coil.

The Ford was, possibly, the only car using the first method, and it was also the only one using a vibrating coil. With the usual non-vibrating coils it was, of course, necessary to have an interrupter synchronous with the contacts on the H. T. distributor. These were of two types:

(a) The long contact or closed circuit system.

(b) The short contact or open circuit system.

The latter method had to a great extent replaced the closed circuit for one obvious reason, viz., the drain on the battery and resultant economy, although the closed circuit advocates claimed "perfect synchronism" and therefore elimination of mechanical and electrical lag. By "electrical lag" was meant that the spark would not occur in the same position as regards piston travel at different speeds. The "open circuit" had to both close and open the circuit, and therefore the range of time for a possible misfire was longer.

The reason for discarding the vibrating coil was that the latter gave rise to a succession of sparks, the hottest of which usually determined the ignition. Ignition ought to occur with the first spark at the end of the compression stroke, but was generally late.

One favorite type of open-circuit ignition was the Atwater-Kent. Its interrupter was so rapid that the eye could not follow the contact. An actual breaker was shown, with slides illustrating the trigger action. In the one shown the condenser was included with the breaker, but on most systems the condenser was connected directly across the primary coil and included in the coil box.

A study of diagram, Fig. 1, showed how that was possible, since the condenser, usually connected across the interrupter contacts, in this case included also the battery.

The Delco, 1916, was a similar type, but as it did not include a trigger, a resistance unit to limit the current in the primary coil at low speeds was used. In former types, when dry batteries were used as an auxiliary, a relay or vibrator cut down the current. This had now been discarded. The automatic spark advance, which had been also discarded in the very latest types, was a device introduced to overcome the mechanical lag mentioned above. A slide showed the mechanism.

The Westinghouse system showed how the timer or interrupter, the distributor, and the coil could be combined in one unit. The polarity switch, which was intended to reverse the current periodically through the interrupter contacts, prevented the wearing away of the positive contact and the deposit of metal by electrolytic action on the negative contact. The ballast resistance unit was similar to the Delco, the rise in resistance through heating causing the current to remain practically constant in the primary coil at all speeds, and if perchance the circuit remained closed when the car stopped, would materially reduce the drain on the battery if the ignition switch was left in the "on" position.

Sketch of Westinghouse

One example of the long contact or closed-circuit system was the Connecticut. This had a five-terminal coil, because the interrupter contacts and primary circuit were insulated and not grounded, as in the Remy three-terminal coil. The Connecticut had a thermo-static cut-out, which actuated a mechanism to throw out the main circuit-breaker if the ignition switch was left "in" for more than two minutes after the car was stopped. This was merely a double bar of brass and iron heated by a small coil of Nichrome resistance wire. The switch-box was shown.

Magnetos

As regards magnetos there were two systems:

(a) An L.T. magneto, combined with a separate H.T. coil.

(b) An H.T. magneto, a complete ignition unit.

There were two interesting improvements in recent magnetos. First, the Bosch N U 4 (used on the Overland) dispensed with the distributor altogether and used two half-segment insulated slip-rings, each half segment being diametrically opposite, and connected each to one end of the H. T. coil of the magneto instead of grounding one end of the winding, as was usual. There were four brushes, with two spark-plugs in series, so that the spark occurred in two cylinders simultaneously, the extra spark doing no harm, as it took place during the exhaust stroke in one cylinder.

The second innovation was the "rocking field" or the rotation of the magneto so as to make the sparking uniform at all speeds. In an ordnary magneto the most effective spark was obtained only at one position, the armature circuit

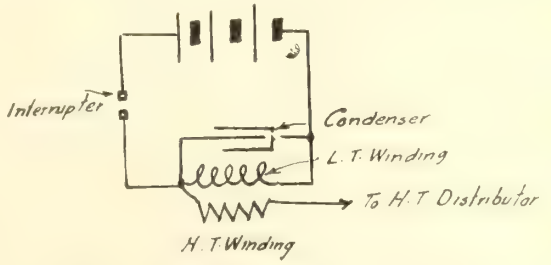


Fig. 1—Condenser connected across primary coil.

being opened when the armature core had just passed beyond the point at which it bridged the pole pieces. When the spark was retarded the opening of the circuit occurred somewhat later, with a wider gap between the iron of the armature core and the pole piece, and consequently produced a weaker spark. Generally magnetos were designed in this way

so that in starting, with the spark retarded, the magneto was working under great disadvantages. Some makers had tried to reverse the order, under the impression that the higher speed in running would compensate for the weaker effect of the armature position, but Taylor, in the Electric Journal for May, 1917, has shown this is a fallacy, as a magneto gives its best effect at 900 r.p.m. and then falls off again with higher speed. If the magnets could be rotated at the same time as the spark lever, to keep the relative postion of armature and pole pieces the same at all speeds, the spark would be the same.

The author then proceeded to describe the Mea and the Dixie as examples of this method. A Dixie magneto was taken to pieces to illustrate the action. The Dixie had other innovations which were ingenious. The contact points on the interrupter admitted of adjustment, while running, and the distributor block on the eight-cylinder set was built in two parallel planes with only four contacts in each, any one contact in one plane being displaced at 135 degrees to a contact in the next plane. This eliminated the difficulty of constructing eight points in one plane. The magneto in this case ran at engine speed, instead of the usual double-speed ratio.

The Bosch two-spark ignition used a double distributor, with an additional spark-plug in each cylinder, arranged directly at the inlet valve with the H. T. winding of the magneto connected to the central point on each distributor. In any motor the object of advancing the spark was to compensate for the slow development of the explosion pressure. Double-pole or two-spark ignition increased enormously the rate of development, with a consequent reduction of the advance necessary. It might be cut down 30 to 50 per cent. Power was gained through avoiding the back pressure at the end of the compression stroke, caused by too much advance in the single-plug method. A retarding effect could be obtained by short-circuiting one set of plugs. To overcome the objection to the weak spark of an ordinary magneto at starting, impulse starters had been introduced. In the Zistram, or K.W. starters, the armature, at slow speeds, rotated in a series of jumps, caused by a fixed notched bar and an extended spring. At high speeds centrifugal action cut out the device.

Electric Starting and Generating Systems

The above were classified into (a) single unit; (b) two unit; (c) three unit types.

In (a) a motor-generator unit charged the battery, operated the lights, and acted as a cranking motor. Sometimes two units in one frame were erroneously classed as a single unit.

In (b) there was a generator for charging and taking care of the lights and ignition, with a separate unit for cranking; while in (c) there was a generator for charging and lighting, a motor for cranking, and a magneto for ignition.

Starting motors were arranged either to drive (1) through the flywheel or (2) through a gearing to the crankshaft. The latter required no starting resistance.

In regard to the voltage at the motor terminals, six-volt systems had several advantages over the twelve-volt. There was greater stability of the lamps filaments, and in certain instances the six-volt battery weighed 35 per cent. less than the twelve-volt for the same capacity in watt-hours. The reason for the greater weight of the twelve-volt is that, starting from a given three-plate cell of one positive and two negatives, doubling the capacity for the same voltage would only require two more plates, with a slightly larger cell, while doubling the voltage would mean another complete cell.

As far as the starting motors were considered, it was easier to design a twelve-volt than a six-volt machine, but their efficiencies and costs were practically identical. The type of battery used for starting was invariably the lead cell, on account of the fact that its only competitor, the Edison battery, while a favorite for lighting, had such a high internal resistance that it could not furnish the necessary starting torque unless it had twice the weight of the lead cell. Quoting from a paper read by Bailey before the A.I.E.E., we find that a 50 amp.-hr. load battery (three cells) weighed 45 pounds, while the same capacity Edison, with four cells, giving nearly the same voltage, weighed only 37 pounds. This Edison battery would be satisfactory as regards lighting, but on occasion the lead cell could provide 135 amperes at 5.2 volts or 702 watts, assuming an internal resistance of .002 ohms per cell. To compete with this a much larger Edison (the A6) would be required, having an internal resistance of .002 ohms. This battery would give 194 amperes, but with a drop of 1.9 volts or a terminal voltage of only 3.62 the watts would be the same as above, viz., 702. Its weight would be 80 pounds, or nearly double that of the lead battery. If the resistance of the motor was .0085 ohms, since the total internal resistance of the Edison is .0096 ohms a current of 310 amperes, as against 415 for the load battery, is all that is available for starting. This would mean that the lead cell would give a 35 per cent. better starting torque.

The various methods of placing the starting motor were then explained. Wherever planetary or double-reduction gearing was used the efficiency of the drive was reduced to 65

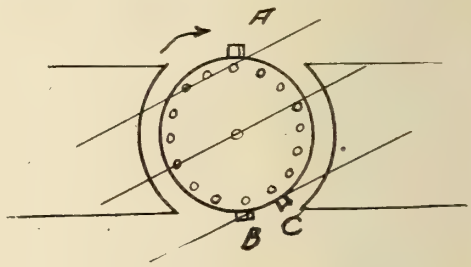


Fig. 2—Generator with three brushes.

per cent. as compared with 90 per cent. for single reduction. Slides were shown of the over-running clutch for cutting out the motor when the engine was driving, and of a favorite form of drive called the Bendix drive.

Generating Systems

Turning finally to generating systems, the author explained the principles involved. It was necessary to have the battery on charge when the car had attained a speed of from seven to ten miles an hour. In order to prevent the lights being burnt out at excessive speed some method of controlling the output was essential. To prevent the battery motoring the generator when the speed dropped below normal the circuit was generally broken by some form of automatic cut-out and cut-in switch.

The methods of regulating were classified as follows:

(a) By field windings on the generator poles (reverse compound).

(b) By electro-magnetic devices controlling the shunt field current (vibrating and other types).

(c) By mechanical governors, keeping the generator speed constant.

(d) By thermal devices (increased ballast resistance).

(e) By third brush excitation of the shunt winding.

The slides showed a Westinghouse system illustrating the first method, the Gray and Davis, and the Bijur, vibrating shunt control, the now discarded Gray and Davis slipping-clutch constant speed system, the old Delco Mercury tube regulator, and the modern Delco third-brush control.

The last method has been adopted recently by so many makers on account of its simplicity that it deserved more than passing attention.

About 1890 Sayers devised a generator with its shunt

field connected between one of the main brushes and a third brush placed a few segments away from the other brush, Fig. 2. If a test were made on any generator, as the load was increased it would be found that a voltmeter would register an increased voltage between one of the main brushes and a certain segment on the commutator, while the voltage would decrease between the other brush and the same segment. Sayers used the first method of connection to keep the voltage of his generator constant, while the second arrangement was the method required to automatically reduce the shunt field current as the speed of a generator on an automobile increased. The effect was due to distortion of the magnetic lines from the main poles as they passed through the armature, by the magnetic field produced at right angles to the main pole field, due to the current in the armature.

In the 1918 Delco set, which was shown to the members, it was interesting to note that the automatic cut-out, the vibrating relay, and even the automatic spark control had been dispensed with, the whole tendency of modern work being to simplify.

The paper was completed with a description of the all-electric Owen car, using the General Electric Tntz transmission system for dispensing with the change-speed gears.

Growth of Montreal Tramways

At a luncheon of the Rotary club of Montreal recently Mr. M. J. Hannaford, assistant engineer of the Montreal Tramways Company gave a very interesting talk on the history of the company and some of the present operating difficulties experienced. The first street car, he said, was used in 1718, although not in Montreal. Strap iron rails were used; then cut stone and lumber substituted. In 1776 the first successful formed rail was laid. To-day rails from 56 pounds per yard to 164 pounds are used in street railway work; in Montreal they use 116 pound rails, 7 inches high. The old Montreal City Passenger Railway Company was formed in May, 1861, starting with 8 cars and six miles of rails. Several extensions were made later, and in 1892 the line was electrified, there being 12½ miles of track. In 1893 there were 94 miles and in 1916 260 miles. Eight hundred and sixty cars are being used at the present time, not including the small ones used during rush hours. Some of the cars are of the p.a.y.e. type.

Referring to the present high cost of maintenance Mr. Hannaford said that the steel alone for a crossing like that at Guy and St. Catherine Streets would cost from $6,000 to $8,000, and labor about the same. Track construction on main streets costs about $42,000 a mile.

Personals

Mr. J. D. Johnston, for five years manager of the B. C. Telephone Company at New Westminster, has been appointed accountant at the Vancouver office.

Mr. R. P. Dryer, assistant sales manager, Canadian Allis-Chalmers, Limited, Toronto, has resigned to take a position in the Pittsburgh office of the Allis-Chalmers Mfg. Company of Milwaukee.

Mr. C. J. Bats, manager of the Hydro-electric Department at Walkerville, has been appointed manager at Leamington, Ont., and is assisting in the change-over from the Edison interests.

Mr. James H. Spicer, formerly chief draftsman and shop superintendent of the bridge department of the Canadian Allis-Chalmers Company, is now works manager for C. W. Hunt Company, Inc., West Brighton, N.Y.

Mr. E. K. Adamson, who has been elected an associate member of the Canadian Society of Civil Engineers, is the resident engineer and superintendent for the Western Power Co. of Canada at Stave Falls, B.C., the maintenance of dams, railway, and general construction being under his charge.

Mr. W. R. Warren, Regina, A.M.I.E.E., has been elected an associate member of the Canadian Society of Civil Engineers. He has had British experience and in 1912 was appointed chief engineer of the department of telephones, province of Saskatchewan, in charge of the construction, maintenance and operation of the system.

Mr. E. C. Adair Hanson, A.M.S.E.E., M.I.M.E., London, the electrical engineer of the city of Saskatoon, has been elected an associate member of the Canadian Society of Civil Engineers. Mr. Hanson, in addition to experience in the Old Country, has held positions with the Canadian General Electric and Montreal Light, Heat and Power Companies.

Mr. Howard Murray, vice-president and for several years manager of the Shawinigan Water & Power Company, has been appointed manager of Aldred & Company, Limited, Montreal, just formed, with a capital of $1,000,000, to carry on the business of investment bankers and fiscal agents. Mr. J. E. Aldred is the president of the Shawinigan Water & Power Company.

Captain R. H. Nichols, who is well known in electrical circles and has been on overseas service with the Canadian Expeditionary Force, returned to Toronto last month for a short time before going to India under the direction of the Imperial Minister of Munitions. Captain Nichols has been appointed general manager of the Bengal Iron & Steel Company, Limited, Kulti (E.I.R.), Bengal, India, a corporation employing 25,000 men.

Mr. E. A. Jacobson, general manager of the Boving Hydraulic & Engineering Co., Ltd., has been elected a member of the Canadian Society of Civil Engineers. Mr. Jacobson studied hydraulic engineering in Sweden, the United States and Germany, and carried out work in the two former countries. He later was appointed chief engineer of Boving & Co. of Canada, Ltd., and in 1915 assumed his present position with the Boving Hydraulic & Engineering Co., successors to Boving & Co.

Obituary

Many friends throughout the Dominion will have learned with regret of the death, in France, of Michael Chapman, formerly of Chapman & Walker, Toronto, and previous to that with the Canada Foundry Company. Mr. Chapman took the officers' training course in 1915 with the Royal Grenadiers, and later obtained a commission with the Grenadier Guards in England. He leaves a widow and a young son and daughter.

Mr. Alfred R. Miller, treasurer of the Canadian Westinghouse Company, Limited, died on Sunday, April 28th, 1918, at Hamilton, Ont., aged 43 years. Mr. Miller was born in England, and removed to Canada with his parents at an early age. His whole business life was virtually spent with the Westinghouse interests in Canada, having entered their employment in his young manhood, about twenty years ago, and by his ability, industry and close application to business, progressed with the company until at the time of his death he occupied the responsible position of treasurer. Mr. Miller endeared himself to a host of friends by his kindly disposition and thoughtfulness for others.

The Ferranti Electrical Company of Canada, Limited, announce a change in address of their Montreal office from 704 Unity Building to Room 101, Southam Building, 128 Bleury Street.

The Dealer and Contractor

Costs and Accounting for the Electrical Contractor—Co-operation of Manufacturers and Wholesalers Needed—He the Poor Credit Risks

At a time when the Toronto Electrical Contractors' Association is wrestling with the problem of establishing a uniform system of accounting, our members will be encouraged to know that the National Electrical Contractors' Association are wrestling with the same problem, equally siezed of its importance and equally determined on a solution. At the recent meeting in Detroit, which by the way was attended by our president, Mr. K. A. MacIntyre, Mr. J. E. Sweeney, Chairman of the National Committee on Costs and Accounting, after a thorough study of the subject, made the following report. Mr. Sweeney outlined the work of the Credit and Accounting Committee as follows:

> To collect information on improved bookkeeping systems and methods of cost accounting, overhead, etc.; to improve the credit of members; to obtain information as to the credit of customers of members and to furnish information as to the best ways of collecting accounts, etc.; to confer with National Electrical Credit Association and other credit associations.
>
> The work of this committee, as I see it, is divided into four parts, as follows:
>
> First, collecting information regarding a suitable bookkeeping system and getting this information into form to submit to our members with the recommendation that they use it.
>
> Second, collecting information and data on Cost Accounting and Overhead Expenses to be submitted to our members for their guidance in conducting their business.
>
> Third, to study the problem of improving the credit ratings of our members and to furnish information as to the best methods of collecting accounts due them.
>
> Fourth, to obtain information as to the credit of customers of members

On these various topics Mr. Sweeney made the following remarks, as reported in the Electrical Contractor-Dealer:

In connection with the first item, the bookkeeping system. It is my idea that this should conform as nearly as possible to standard accounting practice, and if this is adhered to the system can be submitted to any contractor, regardless of the size of his business, for his use, and it should place him in a position to draw off a statement of his assets and liabilities that can be presented to his banker or wholesaler in an intelligent manner. In connection with this bookkeeping system there should be a standard classification of accounts for the use of the contractor and dealer. This should not only include the capital accounts appearing in the statement of assets and liabilities, but should include accounts covering expense items that go to make up the overhead, or cost of doing business. I have prepared a statement of assets and liabilities, also a list of expense items which is shown herewith. These have been presented at the various district meetings of our State Association, at which were present jobbers and central-station men, as well as the contractors. During these meetings much discussion has been produced regarding the relation of one account to another, and how a good or bad condition may be shown by the statements; also how a general analysis of the running of the business can be obtained from a comparison of the accounts shown in the statement. All of this pertains to the bookkeeping system or accounting, but is very closely allied to the general question of credit.

Collection of Cost Accounting and Overhead Expense Information

In regard to the second division of work, the Collecting of Information and Data on Cost Accounting and Overhead Expense. The statement of these items, which is itemized here, shows the general expense items that compose the cost of doing business. If it were possible to get all of the contractors to designate their expense items in the same manner, and by the same name, in a short time we would be able to collect very valuable information regarding the relation of various expense items to the amount of business done, and it would be possible to take any concrete example and work out with a fair degree of accuracy whether the business in question had a fair chance to succeed, and, if not, it could be determined just where the fault lay and steps could be taken to have the trouble corrected. We should have these expense items worked out on a percentage basis against different classes and different volumes of business.

Improvement of Credit Rating

Third: Regarding the problem of improving the credit ratings of the members and to furnish them with information as to the best methods of collecting accounts. This is a pretty large subject, and the best method of procedure must be determined after consulting with the National Electrical Credit Association, the jobbers, manufacturers, and others interested, as well as the members of our own executive committee. The fundamentals of a credit risk are character, capacity and capital, which means that the members should be of good general and moral character, and have such other qualifications as are required to be known as a man of good character; and next, that they should have capacity of ability to understand running their business in a business-like way; and right here, in addition to technical ability, could be included that they should have a uniform system of accounting, maintain a good cost system, and have such other up-to-date business methods as are required in other lines of successful business.

And finally, in the matter of capital I believe that, gen-

rally speaking, the contractor is almost invariably short of unds in his business. We should so build up the qualities f character and capacity that it will be easier for him to ecure additional capital to extend his business, or handle is present business without embarrassment or without asking or unwarranted favors from his wholesaler or banker.

Determination of Credit of Customer

Fourth, regarding the matter of obtaining information s to the credit of customers of members. It seems to me hat there is very little that can be done by our Association in this regard as far as local information is concerned.

In general, it seems as though it should be possible to adopt a system of bookkeeping and accounts and publish a booklet covering the subject in detail, which could be distributed to members. I think we could be reimbursed by the cost of the book by charging a dollar a copy, or whatever was necessary to defray the expense, and it would be my recommendation that we co-operate with the Electrical Credit Association, the Society for Electrical Development, the Jobbers' Association, and any others who may be interested, with that end in view of finally making a summary of the information and data collected, to be distributed at the lowest possible cost. This book would, of course, cover the general information regarding a suitable bookkeeping system, but would leave the selection of the different types of books to use to accomplish the results to the individual judgment. It would also cover the matter of Cost Accounting and itemize the items that go to make up "overhead," and give the correct method of figuring the overhead costs.

In regard to the matter of credit, it seems to me as though this will eventually take care of itself as we get better and more accurate bookkeeping and cost-accounting systems; but we must have the co-operation of the manufacturers and wholesalers in the building up of the credit of our members. Probably our greatest trouble right now is caused by these branches of the industry going out and selling to so-called contractors who are not worthy of credit, who never have been worthy of credit and at the time the sale was made had no indication of having the proper requisites, namely, character, capacity and capital, which would entitle them to credit. When the loss comes, as it must when credit is granted on this basis, the jobber and manufacturer set up the complaint that the contracting business is a hazardous business, and that all contractors are poor credit risks, whereas their particular trouble is with themselves rather than with the contractor. Their credit men and their salesmen should be educated as well as the contractor. They should confine their selling efforts to establishing electrical contractors of sound credit rating, and this will do as much, or more, good to establish the credit of our business as any one thing that I know of.

Statements of Assets and Liabilities

ASSETS

Current
- Cash in bank
- Petty cash fund
- Certified checks outstanding
- Accounts receivable
- Notes receivable
- Liberty bonds
- Trade acceptances

Inventories
- Merchandise
- Wiring supplies
- Fixtures and glassware
- Motors
- Appliances
- Work in progress

Fixed Investments
- Furniture and fixtures
- Auto-Truck
- Buildings
- Real Estate

Prepaid Values
- Insurance
- Association membership
- Miscellaneous

LIABILITIES

Current
- Accounts payable
- Notes payable
- Notes payable—Liberty Bonds
- Trade acceptances

Capital
- Capital invested or Paid up capital stock

Surplus Account
- Undivided profits

Current Profits
- Earnings for period

Reserve Accounts
- Bad and doubtful debts
- Interest
- Depreciation—F. & F.
- Depreciation—Auto-Truck
- Depreciation—Tools
- Taxes

EXPENSE ITEMS

Comprising Cost of Doing Business Known as "Overhead Expense"

- Salaries—Management
- Salaries—Sales
- Salaries—Office
- Salaries—Shop
- Commissions—Bonus
- Rent—Heat—Water
- Light and power
- Telephone and telegraph
- Fire insurance
- Iowa compensation insurance
- Liability insurance
- Advertising
- Taxes
- Interest on borrowed capital
- Auto expense
- Truck expense or delivery
- Association membership
- Office expense
- Travelling expense
- Office supplies
- Donations
- General expense
- Repairs and upkeep
- Losses—Bad accounts
- Depreciation
  - Auto truck
  - Furniture—Fixtures
  - Tools
  - Stock
- Service account
- Shop expense and supply account
- Interest on invested capital

A "Convenience Outlet" Campaign

The Society for Electrical Development have decided to conduct a "Convenience Outlet" campaign to be carried out along lines similar to the "Wire Your Home" and "Electrical Christmas" campaigns. The Society will issue attractive booklets, folders and lithograph posters and will endeavor to procure the co-operation of the entire industry in educating the public to an appreciation of the convenience of additional outlets, preferably on a separate circuit to the lighting system. With the scarcity of servants and the general plentiful supply of money it is felt that the time is opportune to induce the people to add to the comfort of their homes in this way, at the same time assisting in the conservation of coal.

The thirty-fourth annual meeting of the National Electric Light Association, and its forty-first convention, will be held at the Hotel Traymore, Atlantic City, on June 13-14. All business will be devoted to problems arising out of the war.

Irving Smith, Electrical Apparatus and Specialties, Montreal, P.Q., announces his change of address to 602 New Birks Building, 10 Cathcart Street. He was formerly at 809 Unity Building.

Trade Publications

C.G.E. Publications—Bulletin No. 48025, describing electricity in logging and sawmills; chart describing C.G.E. round pattern curve drawing instruments, both a.c. and d.c., and bulletin No. 42552A describing motor generator sets. All bulletins illustrated.

The Ohio Brass Company, Mansfield, Ohio, have issued supplement No. 1, containing additions and improvements in O.B. materials for electric railways, mine haulage and Hi-Tension porcelain insulators. This supplement is to be used in conjunction with general catalog No. 16.

Rheostats—Circular No. 502, by the Ward-Leonard Electric Company, describing current regulating rheostats for 32 volt lighting plants and for 20 ampere moving picture lamps. The same company have also just issued a price and data book on armature speed controllers and a leaflet on small circuit breakers.

Crocker-Wheeler—Bulletin No. 183, describing motor drive for printing machinery; bulletin No. 184, direct-current lighting and power generators, direct connected and engine types, 25 to 3750 kilowatts, and bulletin No. 185, coupled and belt types of alternating current generators, two and three phase, 50 kv.a. and up. All bulletins well illustrated.

Code of Lighting for School Rooms

Revised Edition Jus Issued by the Illuminating Engineering Society—Of Extreme Importance to the Future Well-being of the Race

The Illuminating Engineering Society recently announced that the revised edition of the code of lighting for school buildings would be published in the near future and this edition is now in type. Copies of the code may be obtained at nominal cost from the New York offices of the society.

From time to time we have printed extracts from this code as variations have been made, feeling that the importance of the subject justified all the publicity it could be given. Following this policy we are printing below copious extracts from the revised code and urge that engineers bring the important matters contained therein as forcibly as possible to the attention of school boards everywhere. The importance of conserving the sight of our school children cannot be overestimated and the cost of proper lighting to-day is very much less than the average school trustee imagines. The latest types of lamp have gone a long way towards making ideal school lighting a possibility at small cost.

CODE OF LIGHTING SCHOOL BUILDINGS

Article I. General Requirements.—When in use, all buildings should be provided, during those hours when daylight is inadequate, with artificial light according to the following Articles.

Buildings hereafter constructed should be so designed that the daylight in the work space is reasonably uniform and the darkest part of any work space is adequately illuminated under normal exterior daylight conditions:[2]

Article II. Intensity of Artificial Illumination.—The desirable illumination to be provided and the minimum to be maintained are given in the following table:[2]

Desirable and Minimum Illumination

	Artificial lighting Foot-candles (Lumens per Square foot)* at the work	
	Minimum	Ordinary Practice†
Storage spaces	0.25	0.5- 1.0
Stairways, corridors	0.5	1.0- 2.5
Gymnasium	1.0	2.0- 5.0
Rough shop work	1.25	2.0- 4.0
Auditoriums, assembly rooms	1.5	2.5- 4.0
Class rooms, study rooms, libraries, laboratories, blackboards	3.0	3.5- 6.0
Fine shop work	3.5	4.0- 8.0
Sewing, drafting rooms	5.0	6.0-12.0

Article III. Shading of Lamps.—Lamps should be suitably shaded to minimize glare. Glare, either from lamps or from unduly bright reflecting surfaces, produces eye-strain.

Article IV. Distribution of Light on the Work.—Lamps should be so arranged as to secure a good distribution of light on the work, avoiding objectionable shadows and sharp contrasts of intensities.

Article V. Color and Finish of Interior.—Walls should have a moderate reflection factor; the preferred colors are light gray, light buff, dark cream and light olive green. Ceilings and friezes should have a high reflection factor; the preferred colors are white and light cream. Walls, desktops and other woodwork should have a dull finish.

Article VI. Switching and Controlling Apparatus.—Basements, stairways, store rooms, and other parts of the building where required, should have switches or controlling apparatus at point of entrance.

Article VII. Emergency Lighting.—Emergency lighting should be provided at main stairways and exits to insure reliable operation when, through accident or other cause, the regular lighting is extinguished.

Article VIII. Inspection and Maintenance.—All parts of the lighting system should be properly maintained to prevent deterioration due to dirt accumulation, burned-out lamps and other causes. To insure proper maintenance, frequent inspection should be made at regular intervals.

DAYLIGHT

Intensity of Daylight.—In general, the minimum intensities of daylight illumination should be considerably greater than those provided in artificial lighting, owing to the adaptation of the eye to a much higher level of illumination (brightness) in the daytime.

Direction of Light.—One of the fundamental rules for proper lighting of desks is to have the preponderance of light come from the left side. For this reason many school authorities advocate unilateral lighting, that is, lighting by windows located on one side of the room only, especially for class rooms. This method of lighting is recommended where the rooms do not exceed about 24 feet (7.9 m.) in width, with windows about 12 ft. (3.9 m.) high. If the rooms are much wider than this, bilateral lighting, that is, lighting by windows located on two sides of the room, may be required in order to provide sufficient illumination in every part of the room and at the same time to prevent too great a diversity of contrast in the intensity of light on the work spaces.

To secure the highest lighting value it is recommended that the room be so designed that no working location is more distant from a window than one and one-half times the height of the top of the window from the floor.

Windows at the left and rear where practicable are preferable to those on the left and right sides of the room, because of cross shadows created by the latter arrangement. Lighting by overhead sources of natural illumination although sometimes used for assembly rooms, auditoriums and libraries, with relatively high ceilings, has ordinarily little application in class rooms and has found little favor in practice.

The sky as seen through a window is a source of glare. For this reason the seating arrangements should always be such that the occupants (pupils) of the room do not face the windows.

Window Openings.—Tests of daylight in well lighted school buildings indicate that, in general, the glass area does not fall below 20 per cent. of the floor area.

As the upper part of the window is more effective in lighting the interior than the lower part, it is recommended that the windows extend as close to the ceiling as practicable.

Lighting Value of a Window.—The lighting value of a window at any given location in the room, will depend upon

*It should be borne in mind that intensity of illumination is only one of the factors on which good seeing depends.

†Under the column headed "Ordinary practice," the upper portion of the range of intensities is preferable to the lower; where economy does not prohibit, even higher intensities than those cited are often desirable.

‡Daylight illumination values should be at least twice the values given in the Table, Article II, for artificial lighting.

[2]The illumination intensity should be measured on the important plane which may be the desk-top, blackboard, etc.

The method of computing the flux of light (lumens) required to do any desired illumination is described under the heading "Design of Lighting Installation."

For more specific information regarding the lighting of shops, see "Code of Lighting Factories, Mill and Other Work Places," issued by the Illuminating Engineering Society.

the brightness of the sky, the amount of sky visible through the window at the given location in the room, and indirectly upon the reflection factor of the surroundings and the dimensions of the room.

Observations in well lighted school rooms having a comparatively unobstructed horizon, show that under normal conditions of daylight, satisfactory illumination is usually obtained when the visible sky subtends a minimum vertical angle of 5 degs. at any work point of the room.

In cases in which the horizon is obstructed, as by adjacent high buildings or by trees, provision should be made for a larger window area than would otherwise be required; also if need be, for redirecting the light into the room by means of prismatic glass in the upper sashes of the windows, or by prismed canopies outside of the windows.

Window Shades.—Although direct sunlight is desirable in interiors from a hygienic standpoint, it is often necessary to exclude or diffuse it by means of shades. These shades should perform several functions, namely, the diffusion of direct sunlight, the control of illumination to secure reasonable uniformity, the elimination of glare from the visible sky and the elimination of glare from the blackboards wherever possible. These requirements make it desirable to equip each window, especially in class rooms, with two shades operated by double rollers placed near the level of the meeting rail. The window shades may thus be raised or lowered from the middle, which provides the maximum elasticity for shading and diffusing the light. The shades should be preferably of yellow-colored material that is sufficiently translucent to transmit a considerable percentage of the light while at the same time diffusing it. This method of installation permits of lowering the window from the top or raising it from the bottom without interference with the shades.

A more complete control of the light from the walls of courts is very helpful in increasing interior illumination. Hence the walls of courts should have high reflection factors. Dark colors should be avoided.

Maintenance—Windows and overhead sources of natural light (so-called skylights) should be washed at frequent intervals and surfaces such as ceilings and walls should be cleaned and refinished sufficiently often to insure their efficiency as reflecting surfaces. It should be borne in mind that the maintenance of adequate daylight indoors is also dependent upon various external factors, such as the future erection of buildings and the growth of trees or vines.

ARTIFICIAL LIGHT

Systems of Lighting.—It is customary to divide the systems of artificial lighting into three classes, namely, direct, semi-indirect and indirect. This division is arbitrary and the boundary lines are quite indefinite.

A direct lighting system is known as one in which most of the light reaches the work plane directly from the lighting unit including the accessory which may be an opaque or glass reflector or a totally enclosing transparent or translucent envelope Direct lighting systems may be further classified as localized and general or distributing. In the former the units are so placed as to light local work spaces, and in the latter they are well distributed so as to light the whole area more or less uniformly.

A semi-indirect system is known as one in which a portion of the light reaches the work plane directly from the unit and a relatively large portion reaches the work plane indirectly, by reflection from the ceiling and walls. The accessory is usually an inverted diffusing bowl or glass reflector. When this glass has a high transmission factor the lighting effect approaches that of ordinary direct lighting, and when of low transmission, the effect approaches that of indirect lighting.

An indirect system is known as one in which all or practically all the light reaches the work plane indirectly after reflection from the ceiling and walls. The accessory is usually an opaque or slightly translucent inverted bowl or shade containing a reflecting medium.

All three of these systems of lighting are in successful use in schools. There has been a growing preference for semi-indirect and indirect lighting, especially since the introduction of modern lamps of great brilliancy. Local lighting by lamps placed close to the work is unsatisfactory except for special cases such as the lighting of blackboards, maps, charts, etc.

Shading of Lamps.—Except in very rare instances bare light sources should not be exposed to view. They should always be adequately shaded or completely hidden. Even when shaded by translucent media, such as dense glassware, the lighting units should be placed well out of the ordinary range of vision; in other words, it is recommended that lighting units be of low brightness,[3] even if they are located high in the field of view.

The maximum brightness contrast of juxtaposed surfaces in the normal visual field should be preferably not greater than 20 to 1; that is to say, the darkest part of the work space observed should have a brightness preferably not less than one-twentieth of that of the brightest part.

Glossy Surfaces and Eye-Strain.—Glossy surfaces of paper, woodwork, desk-tops, walls and blackboards are likely to cause eye-strain because of specular or mirror-like reflection of images of light sources, especially when artificial light is used. Matte or dull finished surfaces are recommended. It is to be noted that a high reflection factor does not necessarily imply a polished or glazed surface.

To minimize eye-strain it is recommended that unglazed paper and large plain type be used in school books.

Children should be taught to hold their books properly, to assume a correct position relative to the light source, and to safeguard their vision.

Color of Light.—It has been found in practice that the admixture of daylight and artificial light is not satisfactory unless the latter is derived from lamps designed with special reference to producing daylight color values. Hence in waning daylight it is desirable to shut out the daylight and to use artificial light exclusively unless the lamps are of the type mentioned.

Design of Lighting Installation.—The illumination intensity on the horizontal work plane should be as uniform as

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[3]Preferably not to exceed 250 millilamberts. A millilambert is equal to the brightness of a perfectly reflecting and diffusing surface illuminated to an intensity of 0.929 foot-candle, (0929 lumen per square foot). It is also equal to 0.002 candle per square inch.

The following table shows the order of magnitude of the brightness of some light sources in common use:

	Approximate brightness	
	Millilamberts	Candles per sq. in.
Indirect lighting: ceiling, directly above the lighting unit	5. to 75.	0.01 to 0.15
Semi-indirect lighting: heavy density glassware	35. to 100.	0.07 to 0.2
Semi-indirect lighting: light density glassware	200. to 1,000	0.4 to 2.0
Direct lighting: 10 in. (25 cm.) opal glass ball containing 100-watt vacuum tungsten lamp at center	250. to 500.	0.5 to 1.0
Direct lighting: vacuum tungsten lamp, (frosted) in open bottom reflector	2,000. to 3,000.	4. to 6.
Vacuum tungsten lamp, filament exposed to view	500,000.	1,000
Gas-filled tungsten lamp, filament exposed to view	2,000,000.	4,000
Gas-mantle, bare	15,000.	30
Gas-mantle, concealed in 6 in. (15 cm.) opal glass globe	1,000.	2
Mercury arc tube (glass)	8,000.	16
Daylight: clear blue sky	1,000.	2.

[4]This ratio refers to the light received by the object illuminated and should not be confused with the ratio of 20 to 1 for brightness contrast previously given, which refers to the light radiated by the object. For example, a blackboard and a white sheet of paper on it may receive the same amount of light, but the latter will reflect much more light than the former, thus causing a marked brightness contrast between the two surfaces.

possible. The variation should not be greater than 4 to 1.[4]

The chief factors which must be considered in arriving at the size and number of lamps to be used in a given room are (1) the floor area; (2) the total luminous flux[5] emitted per lamp, and (3) coefficient of utilization of the particular system considered. The first should be measured in square feet. The second may be obtained from a data book supplied by the manufacturers of lamps. The third involves many factors such as the relative dimensions of the room, the reflection factor of the surroundings, the number of lighting units and their mounting height, and the system of lighting. By coefficient of utilization is meant the proportion of the total light flux emitted by the lamps which is effective on the work plane. In the accompanying table approximate coefficients of utilization for modern lighting equipment are given. The work plane in this case is a horizontal plane 30 inches (76 cm.) above the floor. These values refer to the initial installation without any allowance for depreciation.

Approximate Coefficients of Utilization—Modern Lighting Equipment

	Light color walls Light color ceiling	Medium color walls Light color ceiling
Small Rooms (Offices, Corridors etc.)		
Direct lighting; dense glass (open bottom reflectors)	0.40	0.35
Semi-indirect lighting; dense glass	0.25	0.22
Indirect lighting	0.23	0.20
Medium Sized Rooms (Class Rooms, Laboratories, etc.)		
Direct lighting; dense glass (open bottom reflectors)	0.50	0.45
Semi-indirect lighting; dense glass	0.35	0.30
Indirect lighting	0.30	0.25
Large Rooms (Auditoriums, etc.)		
Direct lighting; dense glass (open bottom reflectors)	0.62	0.60
Semi-indirect lighting; dense glass	0.43	0.40
Indirect lighting	0.40	0.38

For determining approximately the size and number of lamps to be used in a given room by means of the coefficients of utilization given in the preceding table, it is necessary to know the luminous output in lumens per watt for the electric lamps considered or in lumens per cubic foot of gas consumed per hour if gas lamps are considered. At the present time (1917) the light output of tungsten filament electric incandescent lamps, based on average service conditions of regularly maintained installations, ranges from 8 lumens per watt for the smaller vacuum tungsten lamps to 14 lumens per watt for the larger gas-filled tungsten lamps employed in school lighting. For incandescent gas systems similar service values range from 150 to 250 lumens per cubic foot of artificial gas consumed per hour. The computation for the total lumens required to give a certain illumination intensity in foot-candles is as follows:

N = number of lamps.
L = lumens output per lamp.
E = coefficient of utilization.
A = area of floor or horizontal work plane in square feet.
I = illumination intensity in foot-candles.

$$\frac{N \times L \times E}{A} = I$$

that is, the number of lamps multiplied by the output per lamp in lumens, multiplied by the coefficient of utilization, divided by the area of the horizontal work plane in square feet, gives the illumination intensity in foot-candles.

If the size of the lamps is to be ascertained the computation is made thus:

$$L = \frac{I \times A}{N \times E}$$

To illustrate by an example, assume a room, whose floor (also work plane) is 30 ft. by 18 ft. (9.1 by 5.5 m.), to be lighted by a semi-indirect system from six fixtures containing one lamp each. It will also be assumed that the ceiling is highly reflecting, the walls moderately reflecting, and the illumination intensity desired is 5 foot-candles. The luminous output required of each of the six lamps will be found by substituting the assumed values in the equation, thus:

$$L = \frac{5 \times 30 \times 18}{6 \times 0.30} = 1{,}500 \text{ lumens}$$

Allowing a depreciation factor of 20 per cent. as representing a well maintained installation, the lumens actually required would be 1,500/0.8 = 1,875 lumens. If gas-filled tungsten lamps are considered, whose average output under service conditions is 12 lumens per watt, it is seen that a 150-watt lamp in each fixture will give the desired results.

If gas mantle lamps are considered, whose average output in lumens under service conditions is 250 lumens per cubic foot of gas consumed per hour, it is seen that a lamp consuming 5 cubic feet of artificial gas per hour will be satisfactory in each fixture.

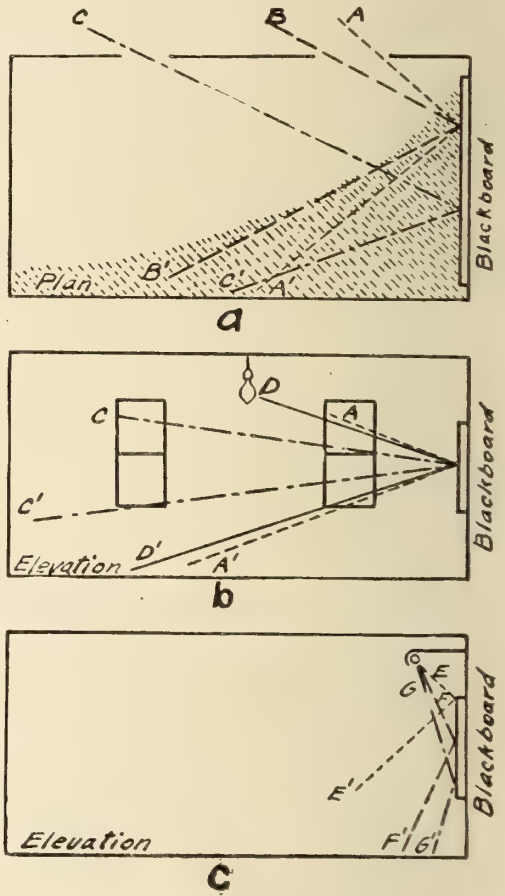


Fig. 1—Diagrammatic illustration of glare from blackboards.
(a) Showing the occupants of seats in shaded area are subjected to daylight glare from blackboards.
(b) Showing angles at which glare is experienced from daylight and from artificial light.
(c) Arrangement of local artificial lighting to minimize glare.

The above example is intended solely to illustrate the method of computation. Estimates of the illumination intensity obtained from an actual installation may also be made by a similar computation.

Suitable switching and controlling arrangements should be made to permit of lighting one or more lamps independently as conditions may require.

The teacher's desk may be illuminated by one of the overhead lighting units, or if necessary, by a desk lamp.

With the usual lighting equipments the distance between the units should not exceed one and one-half times the

[5]The flux is measured in lumens. A lumen is the unit of light flux and is the quantity of light required to illuminate 1 square foot of area to an average intensity of 1 foot-candle.

height of the apparent source of illumination above the working level.

Blackboards.—Blackboards should be of minimum size practicable and should not be placed between windows. Their position should be carefully determined so as to eliminate the glare due to specular reflection of images of either artificial or natural light sources directly into the eyes of occupants of the room. The surface of blackboards should be as dull as possible and this dullness should be maintained.

In order to avoid excessive brightness contrast which is trying to the eyes, blackboards should not be placed on a white or highly reflecting wall.

Rehabilitating the Lighting of Old Buildings.—This will be illustrated by an actual case where the artificial lighting of a class room was made satisfactory at a small expense. In Fig. 2 (a) is shown an elevation of a section of the class room showing the old fixtures. In Fig. 2 the circles containing crosses × indicate the positions of the two old fixtures in this room. The chief objections to this old system were as follows:

(1) The lighting units were hung too low, so that eye-fatigue resulted from the bright sources in the visual field.

(2) The light sources were not shielded from the pupils' eyes.

(3) Two fixtures are insufficient to provide satisfactory illumination over the entire work plane in a room of the dimensions shown. This unsatisfactory condition was remedied by means of six fixtures placed as indicated by the circles.

These fixtures consisted of inverted diffusing glass shades containing one lamp each. The dimensions of the room are shown in the illustration.

Maintenance.—A systematic maintenance should be provided in order to insure against depreciation in the illumination intensity due to burned-out lamps, broken gas mantles, discoloration, etc., and to accumulations of dirt upon the lamps, and upon the surfaces of the reflecting and transmitting media. It is found in practice that carelessness in this respect may easily reduce the effective illumination by 50 per cent., especially in indirect and semi-indirect lighting.

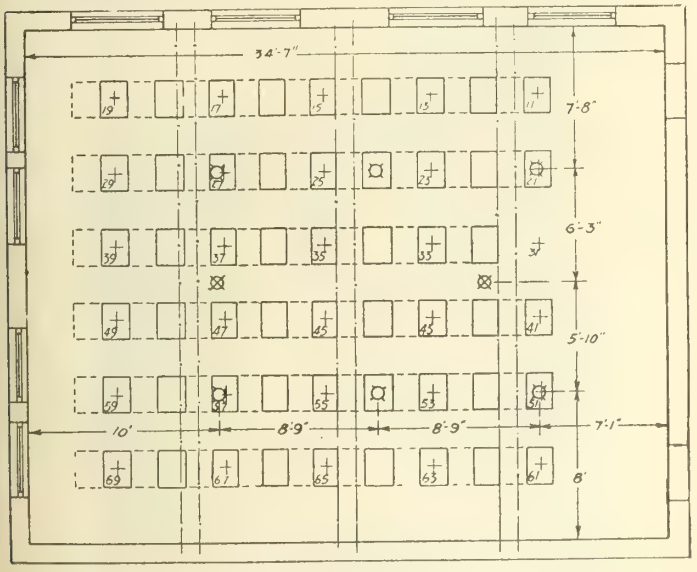


Fig. 2—Two crossed circles represent old lighting, plain circles new outlets for artificial lighting of school room.

Glare, due to specular reflection from blackboards, may be reduced or eliminated by lighting them by means of properly placed and well shaded local artificial light sources.

In Fig. 1 are shown some simple graphical considerations of blackboard lighting. In (a) is shown a plan view of a room with windows on one side. Rays of light are indicated by A, B and C in a horizontal projection. These are supposed to come from bright sky. By the application of the simple optical law of reflection—the angle of incidence is equal to the angle of reflection—it is seen that pupils seated in the shaded area will experience glare from the blackboards on the front wall. In (b) is shown the vertical projection of the foregoing condition. It will be apparent from this graphical illustration that by tilting the blackboard away from the wall at the top edge, the pupils in the back part of the room will be freed from the present glaring condition. Whether or not this tilting will remedy bad conditions may be readily determined in a given case. In (b) the effect of specular reflection of the image of an artificial light source is shown by D. In (c) is shown a proper method of lighting blackboards by means of artificial lighting units. This will often remedy bad daylight conditions whether due to an insufficient illumination intensity of daylight or due to reflected images of a patch of sky.

Fred Thomson Company in New Quarters

The firm of Fred Thomson Company, Limited, manufacturing and contracting electrical engineers, Montreal, have removed from 326-328-330 West Craig Street, to their own new building at 7-13 St. Genevieve Street, a couple of short blocks west of their old location.

This company makes a specialty of electrical repairs of all kinds—from fan motors to the largest electrical units in use in Canada. They also manufacture induction motors up to 25 h.p. capacity and expect in their new establishment to enlarge their already considerable business in this connection They design and build special apparatus of all kinds, transformers, magnetic apparatus, coils, etc., for special purposes They buy, sell and exchange new and second-hand electric motors, generators, etc., a feature of their business being a positive guarantee with any second-hand machine that has gone through their repairing and testing departments.

In their new building, which is of fireproof mill construction and consists of three floors and a basement, and which was designed by Mr. Jas. H. Hunter, of Montreal, to meet their special requirements, they have a total floor space of over 30,000 square feet.

The various floors, which have light on three sides, are arranged to accommodate the different departments.

On the top, or third floor, there are the draughting and designing room, the storeroom, the pattern shop, the transformer department, and the coil making department.

On the second floor, at the front of the building, there are the general office and the two private offices for the officers of the company, and at the rear of these offices the main winding, repairing and testing departments, where the general work of repairing, winding, assembling and testing is carried on. Special reference should be made to the impregnating and baking department, where on a concrete floor are the dipping and impregnating tanks and the electrically heated bake ovens and an overhead travelling crane which handles all motors, motor parts, heavy coils, etc., between the tanks and the ovens. The testing department, switchboard and accessories are equipped for testing at all voltages and at any of the frequencies desired on alternating current and at any required voltage on direct current.

On the first, or ground floor, there are the receiving and shipping room, the showroom where all new and ready-for-sale second-hand machinery is kept, a department where all heavy work of winding, assembling and testing is done and an up-to-date machine shop.

In the basement, which contains the heating apparatus, and which is used principally for storage of second-hand machinery, castings for motors, pulleys, heavy hardware, etc.,

the cutting and punching of the discs for the stators and rotors of their induction motors is carried on.

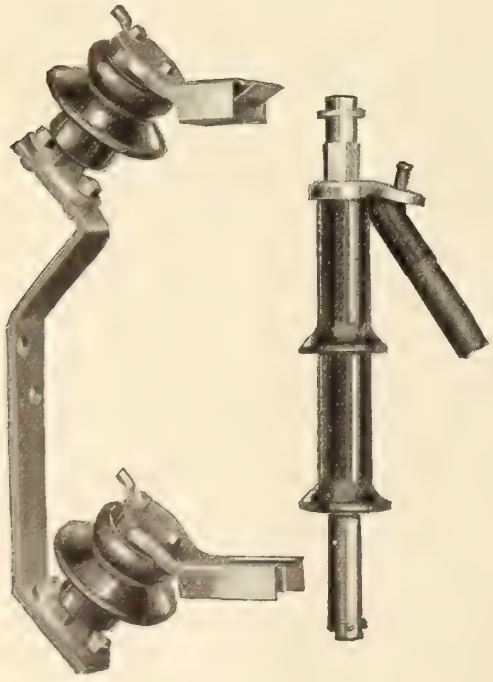
The building is fully equipped throughout with travelling cranes for handling conveniently and with a minimum of labor all apparatus which they are called upon to build or repair, a freight elevator operates between the basement and the top floor, and there are adequate wash rooms and toilet arrangements for the employees; altogether it is in every way an up to date manufacturing establishment.

This company is one of the oldest and best known in the electrical industry throughout the Dominion. The firm was founded by Mr. Fred Thomson, one of the pioneers in the electrical line, who came to Montreal in 1882, and who, after eleven years as chief electrician of the old "Royal" Electric Company, started in business on his own account in a small way in 1894 in a small office in the old Temple Building, on St. James Street. The business grew, and after two or three changes of location, each time to larger premises, they moved to Craig Street in 1899, where they had been established up to the time of their recent removal to St. Genevieve Street.

The officers of the company, which was incorporated as a joint stock company in 1913, are: Fred Thomson, president and general manager; Clarence Thomson, vice-president and secretary-treasurer; H. A. McPhee, superintendent; A. Walker, electrical engineer, and J. B. Lacroix, electrical engineer.

Combined Fuse and Outdoor Disconnecting Switch

In connection with the operation of small outdoor substations the combined fuse and disconnecting switch here shown is used primarily for the protection of transformer banks where no primary switches are required. The fuse is suitable for opening the exciting current of transformer banks not exceeding 300 kv.a. Secondary switches should be provided so that the load can be removed in case it should become necessary to open the primary side with the fuses.



The fuse holder is removed by a fuse hook from the ground. To open the circuit the holder is lifted completely out of the contacts by the fuse hook which is so constructed that the fuse holder will hang vertically when held by the hook. Then if desired, the upper end of the fuse holder is inserted in and hangs from the cap, which partly surrounds the lower contact clips. To close the circuit, the upper contact of the holder is placed in the upper clips by the operating hook and then the lower contact is pressed by the hook into the lower clips. The supporting insulators are of the petticoat type.

The fuse holder has petticoats so spaced as to provide ample creepage surface. The contact parts, at the ends of the fuse holder are of brass and when the holder is in normal operating or closed position engage with the stationary contacts on the supporting insulators. The contacts are protected against the effects of ice, sleet and snow, by the method of mounting and by means of a punched hood attached to the top of each supporting insulator. The fuse passes through the centre of a treated fibre tube within the porcelain fuse holder and is attached to the upper or closed end of the fuse holder by means of an adjustable clamp, and to the lower or open end of the fuse holder by a circular ring, which when tightened, holds the fuse firmly in place without a tendency to shear off. When the fuse blows, the explosion consequent upon the expansion of the gases formed, effectively expels the arc through the open end of the holder downward and instantaneously opens the circuit. New fuses may be inserted readily.

This combined fuse and disconnecting switch, made by the Canadian General Electric Company, and known as the type TD-127, is made in single-pole units for vertical mounting on flat surfaces. It can be obtained for use at 15,000, 22,000, 35,000 and 45,000 volts. The maximum current rating is 50 amperes. No special arrangements are needed for mounting; the supporting bracket is bolted to the cross arm.

A New Type of Safety Switchboard

A novel type of switchboard, known as the Krantz Auto-Lock switchboard, has been placed on the market by the Krantz Manufacturing Company, of Brooklyn. This line of boards has two distinctive features: (1) unit construction, and (2) absolute safety to workmen operating the switches,

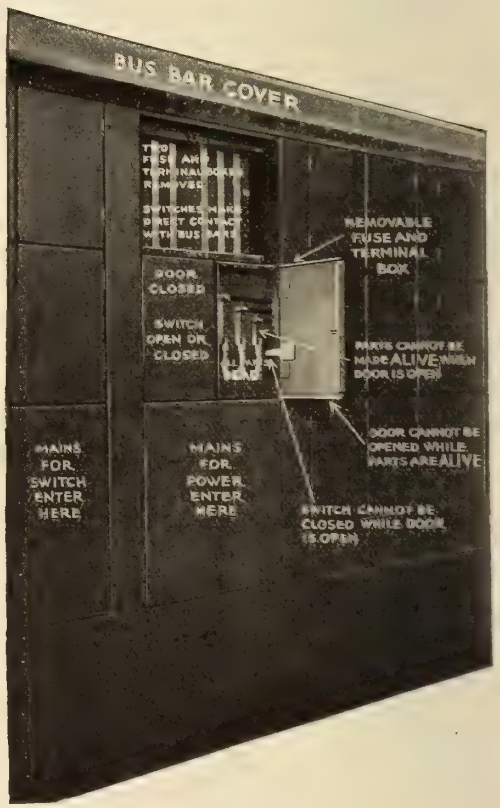


Fig. 1.

renewing fuses, or walking around the board. The unit construction of the board, with each switch in a separate compartment, is best seen from the rear view, Fig. 1. Each of the smaller sections represents a switch unit and each of the larger sections represents compartments for bus bars, wir-

ing gutters, and pull box. The switch unit, as shown in Fig. 2, consists of the enclosing box, the slate base on which the fuses, terminal lugs, and switch contacts are mounted, the switch proper, and the operating lever. The bus bars are mounted on the back of the switchboard slate and when the switch unit is inserted the blades of the switch make direct contact between the bus bars and the fuse terminals. These switches are all interchangeable and may be readily replaced by a switch of larger or smaller capacity, should the occasion arise. Nothing is mounted on the front of the switchboard except the switch handles and a card holder to indicate the circuits controlled by the switch. Since the switch handle is not connected with any surrent carryiing part, the front of the board is absolutely safe. At the back of the board no live parts are exposed, as everything is totally enclosed. If all the switches are closed so that the fuses are alive, all the fuse doors are automatically locked. Should it be necessary to renew a fuse, the switch affected is thrown off and then the switch door can be opened, as shown in Fig. 1. All the current carrying parts are now dead, however,

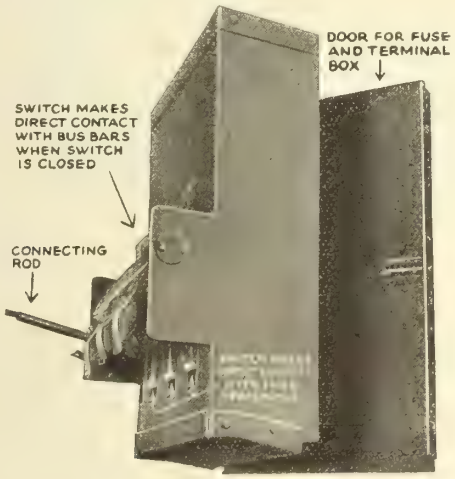


Fig. 2.

and the fuses can be removed without danger. It is also impossible for one man to close a switch when another is renewing the fuses, for the door must be closed tightly before the switch can be thrown on and the fuses energized.

The switch itself consists (when single-pole) of a movable arm. When closed, one end of the movable arm is pressed against the bus bar, and the other end against the fuse terminal, thus bridging the gap between them. When the switch is open, both ends of the arm are clear of their respective contacts. The switch is, therefore, double-break, and when open, leaves the entire fuse box dead. The switch arm is laminated, and makes contact under considerable pressure. It opens with a quick snap, no matter how slowly the operating handle on the front of the panel may be moved. All parts which are not necessary to reach in normal operation are protected by covers held in place by screws. These are readily removed, however, in case of necessity, and every part can be reached for making connections, replacements, etc. The wires can come in at the top or at the bottom and those feeding the switches on the right hand side of the board are placed in the right-hand gutter; those feeding the left-hand switches, in the left-hand gutter. All branch wires are accessible, with the switches open or closed, but no live parts are exposed. No wires cross the bus-bars or the cable terminals.

The Ottawa and Hull Power Company has under consideration the installation of two additional units, each of 7,500 h.p. A considerable amount of construction work has already been done.

Individually Boxed Fixtures

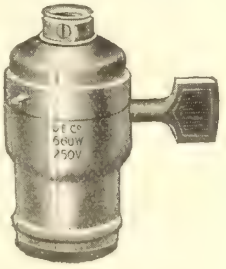
The illustration herewith shows fixture No. 7510, twelve inch, one of the new lines manufactured by W. H. Banfield & Sons, Limited, Toronto. They are furnished in brush brass, Flemish, rich gold, matt, or chocolate bronze. It will be of interest to jobbers and dealers to learn that all of these fixtures are boxed and sealed in individual packages at the



factory, thus eliminating the liability of damage to the finish or the possibility of missing parts. This innovation will prove of value to the dealer where stock has to be repacked and shipped.

New 660 Watt Socket

The Duncan Electrical Company, Limited, of Montreal, are now manufacturing a 660 watt, snap cap, quick-make-and-break brass shell socket, in ⅛ in. and ⅜ in. key and keyless. These sockets are practically adapted for fixture work, as



a narrow groove in the neck of the cap permits a wide turning of the socket even after it is firmly fitted on the stem. The holding catches on this shell and cap are so arranged as to provide a maximum of strength and rigidity.

The Civic Commissioners of Montreal and the Tramways Commissioners have granted to the Montreal and Southern Counties Railway Company an extension for ten years of its contract with the city of Montreal, dating from June 18th. The company will extend its line so as to obtain a connection with the lines of the Montreal Tramways Company and also to enable it to deal more expeditiously with the traffic at the terminal.

Current News and Notes

Aurora, Ont.

The contract for light and power between the town of Aurora and the Toronto and York Radial Railway Company, having reached the time of its termination, the council have notified the railway that they desire another five-year renewal on the same terms and conditions.

Chatham, Ont.

W. H. Somers, of the maintenance department of the Hydro-electric Power Commission, was electrocuted at the Kent sub-station on May 20 by coming into contact with a switch carrying 26,000 volts.

Edmonton, Alta.

New rates on Edmonton street cars came into effect on May 1, as a result of which the cash fare has been increased to 7 cents till 11 p.m., after which the fare is 10 cents. The revised rates fixed by the council are as follows: Tickets purchased off the cars at ticket-selling stations, 5 for 25 cents; tickets bought on the cars, 4 for 25 cents. No workmen's tickets are now issued. Children under six years old are carried free. Tickets for children over six and under fifteen years old and high school pupils carrying certificates, 10 for 25 cents, or one-half fare. Children after 11 p.m. to pay one-half fare. Between 5 and 6.30 p.m. 5 cents to be charged for baby carriages and large parcels. No change has been made regarding transfers on cars.

Eburne, B.C.

A new electric furnace is being installed by the Pacific Steel Works at Eburne, B.C.

Hull, Que.

The Hull Electric Company, Hull, Que., have commenced paving and double tracking their line from Aylmer Road to Montclair Avenue on Montcalm Street and the Chelsea Road—a distance of about one and one-half miles. It is expected to complete the work this year.

Kenora, Ont.

The town council of Kenora, Ont., have adopted a special domestic rate during the months of June, July and August, the price being fixed at 2 cents per kw.h. It is hoped to encourage the use of electricity for cooking.

Montreal, Que.

The first full year's statement of the Montreal Light, Heat and Power Company since the amalgamation of that company with the Cedars Rapids Power Company, shows a gross revenue for the year ending April 30, of $10,390,684. Operating expenses and taxes for the year were $4,767,869. After deducting other charges amounting to $1,039,068 and fixed charges the amount available for dividends is $3,588,725, or 5.6 per cent. on the capital stock. After providing for the annual dividend of 4 per cent. and $20,000 for the pension fund, the total surplus is $1,585,313.

The Corporation d'Energie de Montmagny, Limited, has been formed, with a capital stock of $400,000, to manufacture, purchase and distribute electric power, light and gas in the counties of Lotbiniere, Levis, Dorchester, Beauce, Bellechase, Montmagny, L'Islet, Kamouraska, and Temiscouata. Authority is also taken to acquire and develop water powers and to build conduits, etc.

New Westminster, B.C.

Two more electrically operated lumber plants are being erected on the War Whoop Road and McFarland place, near New Westminster, B.C. With the completion of these two new industries there will be seven electrically operated mills in this immediate neighborhood.

Ottawa, Ont.

The Ottawa city council have named a committee to conduct negotiations and report on the possibility of acquiring the plants of the Ottawa Electric Company and the Ottawa Gas Company, which are controlled by the Ottawa Light, Heat and Power Company.

Perth, Ont.

The High Falls power site at Perth, Ont., has been purchased by the Hydro-electric Power Commission of Ontario, although immediate development is not contemplated.

Peterboro, Ont.

It is stated that the city of Peterboro will shortly employ motorwomen, as well as conductorettes, on the street railway.

Regina, Sask.

A motion introduced in the city council of Regina to increase light and power rates twenty per cent. was defeated but on amendment it was decided to boost the rates ten per cent. The plant has been running at a loss for some time.

Southampton, Ont.

The Saugeen Electric Light and Power Company, Limited, Southampton, Ont., have called tenders for a concrete dam to replace their wooden dam on the Saugeen River carried away by spring freshets. The total width of the dam is 450 feet, of which 150 feet was constructed of concrete in the year 1913 and 100 feet more last year.

Toronto, Ont.

The Toronto Street Railway Company plan putting several p.a.y.e. cars in service shortly.

Vancouver, B.C.

The city of North Vancouver, through Mayor Vance, is endeavoring to secure electric power for industrial purposes at cheaper rates than those in vogue at present from the power supply company operating in the city. Mayor Vance promises a scheme to secure the necessary energy at $50 per h.p. at North Vancouver. From his statement it appears that the Nairn Falls Power Company is offering to the city its water rights (at present conditional), situated at Green River, on the P.G.E. Railway about 90 miles from North Vancouver, for the sum of $75,000. The cost of carrying the installation to the city, with the necessary power plant, is estimated at about two and a half million dollars, the horse-power developed to be about 50,000.

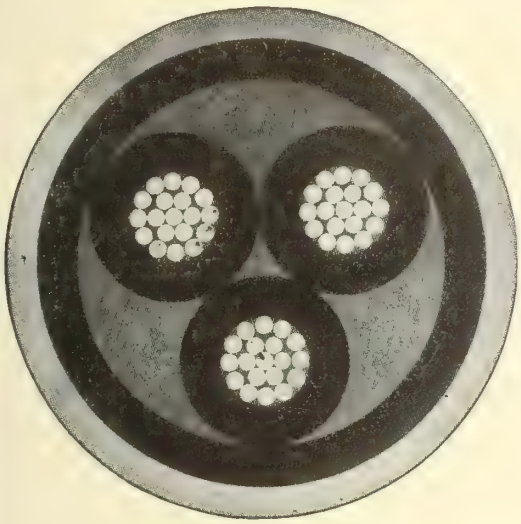
Winnipeg, Man.

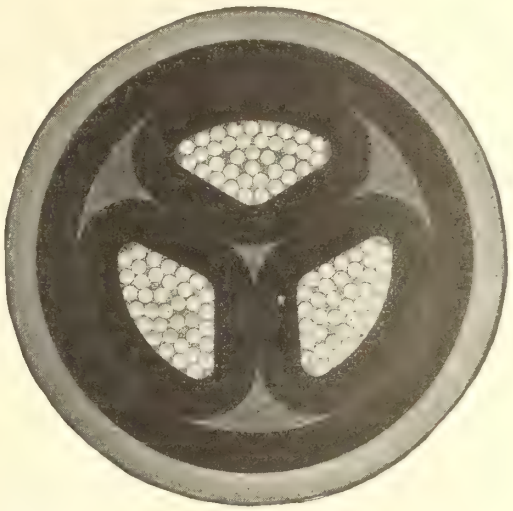
The March report of the Hydro-electric System of the city of Winnipeg shows a surplus of $6,462.64. The operating revenue was $89,815.22. The total expenses, including operation, were $83,352.38. The surplus at March 31 was $236,231.08.

Just as we go to press announcement is made that Winnipeg's strike of civic employees is practically at an end. About three weeks ago the city electricians, waterworks men and health department teamsters struck for higher wages and the dispute eventually involved nearly 15,000 workers of all kinds. It is said that concessions are being made on both sides and the strikers are now all back at work.

PHILLIPS' CABLES

as supplied to the Toronto Hydro Electric System





These illustrations show cross sections in the original size of cables recently supplied to the T. H. E. System and reordered by them for further extensions. The specifications are as follows.—Conductors composed of 37 strands each, .082 in. diameter. Thickness of dielectric on each conductor, .210 in. Thickness in belt, .210 in. Thickness of lead sheath, .160 in. Overall diameter, 2.61 in., 250,000 C.M. Three Conductor, Paper Insulated, and plain Lead Covered Cable for 13,200 volts. We can supply you with wires and cables of any size for Power, Lighting, Telephone, Telegraph, etc.

Write us for detailed information.

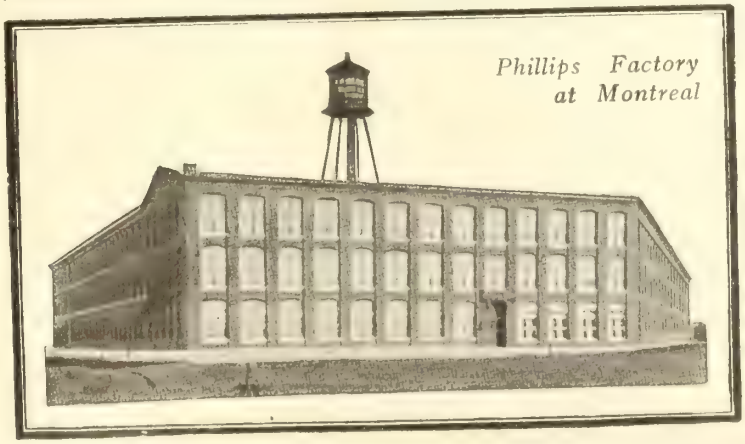
NOTE.—Specification of cable in left-hand cut: 3/0 B. and S. Three conductor. Each conductor 19 strands, each .094 in. diam. Thickness of dielectric on each conductor, .21 in. Thickness of dielectric on belt, .21 in.. Thickness of lead sheath, .15 in. Overall diameter, 2.60.

Specification of cable in right-hand cut: As stated in copy.

Eugene F. Phillips Electrical Works, Ltd.

Head Office and Factory: MONTREAL

Branches: Toronto Winnipeg Regina Calgary Vancouver



Phillips Factory at Montreal

FOR SALE

Duty tungsten or nitrogen, 5 light cluster fixtures, 20" dia. porcelain enameled steel reflector. Malleable iron cross arms, pony glass insulators. High tension mica insulating joint, tested to 34,000 volts. In service for short time. 200 Alabaster Balls, 12 in. x 12 in. x 6 in. fitter. Enquire New

For information regarding the above apply to Galt Hydro-Electric Commission, 50 Dickson St., Galt, Ont. 10-11

MATERIAL FOR SALE

The Toronto Electric Commissioners have for sale a quantity of second-hand 60 cycle transformers, recently in service, also a quantity of electrical supplies. List of materials and full particulars may be obtained on application to the Purchasing Agent, 30 Murray Street, Toronto. The quantities are not guaranteed, and are all subject to prior sale.

No tender necessarily accepted.

Tenders to be in not later than June 5th. 11-11

FOR SALE

1 Madison Williams 30 in., 200 h.p. Triumph Horizontal Steel Case Turbine Water Wheel, 25 ft. head, complete with pulley.

1 60 kilowatt, 2300 volt, 3 phase, 60 cycle, 1200 r.p.m. belted generator with pulleys and rheostats and exciter, Crocker-Wheeler make.

8,166 pounds No. 6 B&S hard drawn bare copper line wire.

1,048 pounds No. 14 B&S hard drawn bare copper line wire.

N. E. CARRUTHERS,
Secretary-Treasurer.

Lacombe, Alta.
May 11, 1918. 11-12

POSITIONS VACANT

WANTED Draftsmen with experience on transformers, induction motors, or direct current machines. Apply stating experience and salary expected, to Box 731, Electrical News, Toronto. 9-11

WANTED—Several experienced draftsmen, more particularly those having experience in switchboards, also draftsmen having experience in generators and transformers. In applying state previous experience, where at present employed, salary expected. Apply Works Engineer, Canadian General Electric Co., Peterboro. 10-11

Is the Electric Motor Cycle Practicable?

Since the earliest days of the electric vehicle, writes the Electrical Times, the possibility of running a cycle on this system has fascinated many enthusiasts, and led to numerous suggestions for a practicable design. There is, of course, nothing inherently impossible in the idea—a machine can be built that will run a reasonable distance at a satisfactory speed, at least on the level, with a motor and battery carried within the frame. It is stated that one firm is placing on the market an electric cycle that with a lead battery will cover 75 miles, or with nickel-iron cells, 150 miles on a single charge, at speeds up to 35 miles per hour. It does not follow, however, that such a cycle would be a commercial proposition, and it is doubtful whether the maximum speed mentioned could be maintained for any length of time without injury to the battery or motor, or to both. The weight of the cycle is given at 225 lbs., and its selling price at $250 with a lead, and at $375 with a nickel battery. The electric cycle would give little trouble, should not be costly to run or to maintain under suitable conditions, would be easy to keep clean, and would make no noise and create no smell, while its simplicity of construction and of control should appeal to those who hesitate to acquire a motor cycle because of its complexity and liability to breakdown. With the electric cycle, of course, there would be no difficulty with the lighting problem, no seperate generator being needed.

PETRIE'S LIST

of New and Used

MOTORS

FOR IMMEDIATE DELIVERY

No.	H.P.	Phase	Cycle	Volts	Speed	Maker
1	100	3	25	550	750	Westg.
2	40	3	25	550	710	Westg.
2	35	3	25	550	720	Westg.
1	20	3	25	550	500	C. G. E.
3	15	3	25	550	750	C. G. E.
2	7½	3	25	550	750	C. G. E.
2	4	3	25	550	1400	Excelsior
2	3	3	25	550	750	C. G. E.
2	2	3	25	550	1400	Excelsior

30 to 60 DAYS' DELIVERY

2	75	3	25	550	750	C. G. E.
1	50	3	25	550	750	Westg.
1	35	3	25	550	750	C. G. E.
1	25	3	25	550	750	C. G. E.
3	10	3	25	550	750	Westg.
1	7½	3	25	550	750	C. G. E.
4	5	3	25	550	750	Westg.

Write Us for Prices

H. W. PETRIE, Limited

Front St. West - Toronto, Ont.

READ THIS!

$2,900 for

275 K.V.A. 25 Cycle
6600 Volt, 3 Phase
275 R.P.M. Generator
or Synchronous Motor

Brand New

Fully Equipped Sw-Bd. and Exciter

ALSO

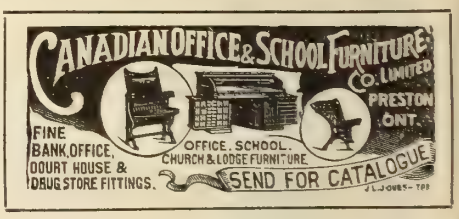
3—100 K.V.A. 25 Cycle
New Transformers S.P.
13,200 to 6600/2200 Volt

$900 each

To be sold immediately

Wire for particulars

E. A. LOWRY - GUELPH, ONT.



Rubber Covered Wires and Cables

FOR POWER, LIGHT AND TELEPHONE WORK

Incandescent Lamp Cord, Flexible Switchboard Cables, Special Cords and Cables for all kinds of Electrical Work.

Prompt Shipments from Canadian Factory.

BOSTON INSULATED WIRE & CABLE CO., Limited

Canadian Office and Factory, HAMILTON, ONT.

Ready for Immediate Delivery

ALTERNATING CURRENT

2—100 K.W., General Electric, 3 phase, 60 cycle, 2300 volt generator, type GTB, form D, complete with switchboards.

1—200 KW., 3 phase, 60 cycle, 1100 volt, General Electric generator, type GTB, form D, speed 600.

1—450 K.V.A., 2300 volt, Allis-Chalmers, 200 speed, 3 phase, 60 cycle generator, 2 years old, good for direct connection for engine drive or water wheel drive.

1—100 H.P. new Westinghouse motor, 3 phase, 60 cycle, 550 volt, 900 speed.

1—100 H.P., new General Electric, 3 phase, 60 cycle, 440 volt, 720 speed, slip ring, complete for heavy starting duty.

1—50 H.P. new General Electric, 440 volt, 1200 speed, 3 phase, 60 cycle, slip ring motor.

1—50 H.P. General Electric, 220 volt, 900 speed, type I, form L.

2—50 H.P. new Allis-Chalmers, 550 volt, 3 phase, 60 cycle, 900 speed motors.

MOTOR GENERATOR SET

1—40 KW., 125 volt, General Electric, 720 speed, type CL, form B, 6 pole generator, connected on one sub base to a 60 H.P., 3 phase, 60 cycle, 2080 volt, 720 speed, type M, form C, Fort Wayne motor in A1 condition and complete. Three bearing machine.

DIRECT CURRENT

2—100 H.P., 110 volt, Holtzer-Cabot D.C. motors, 550 r.p.m., full commutators.

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1	¾	G.E.	110	I	1800
5	1	G.E. NEW .	220	KT	1800
1	1	G.E.	220	KT	1800
1	1	Fbks. M. ...	440	B	1200
1	2	G.E.	220	KT	900
5	2	G.E. NEW .	220	KT	1800
5	3	Wstgh. New.	220	CS	1130
2	3	R&M NEW.	220		1150
3	3	G.E.	220	KT	1800
6	3	G.E. NEW .	220	KT	1200
1	3	G.E.	220	KT	900
3	3	G.E.	220	KT	1200
3	3	Cr. Wh.	220		1720
6	5	G.E. NEW .	220	KT	1800
3	5	Cr. Wh. ...	220	Q	1720
1	5	Cr. Wh. ...	550	Q	1720
1	5	Wstgh.	220	CCL	1700
9	5	Wstgh. New	220	CS	1735
1	5	Wstgh. New	220	CS	1130
53	7	G.E. (motors only)	550		1200
1	7½-15	Cr. Wh.	220/440		865/1735
2	7½	G.E. NEW .	220	KT	1800
1	7½	G.E. NEW .	220	KT	1200
6	7½	G.E. (motors only)	550	KT	1800
2	7½	G.E. NEW .	220	KT	900
2	10	G.E. NEW .	220	KT	1800
4	10	G.E. NEW .	220	KT	1200
1	10	Wstgh.	220	CCL	1700
1	10	Wstgh.	220	CS	1150
1	10	Cr. Wh. with resistance type starter	550	Q	1800
1	10	G.E.	220	L	1200
1	10	Robbins & M	220	K	1750
1	15	G. E.	220	I	900
1	15	Wstgh.	220		1155
2	15	G.E. NEW .	220	KT	900
2	15	Fbks. M.	220/440	KBV	1200
2	20	Wstgh.	220	CS	1160
1	20	Fbks. M.	220	B	1200
50	20	Fbks. M.	220/440	KBV	1200
19	25	Wagner.	220/440	BP	1120
2	30	Wagner New	220		850
1	35	G.E.	220	KT	600
1	35	Triumph.	220/440		900
1	40	Wagner NEW .	220/440	BP	850
1	40	Fbks. M.	220		900
1	35	G.E. NEW .	220	M	900
1	35	Westgh.	220		1170
1	40	Westgh. New	220	CS	870
1	50	Westgh.	220		860
1	50	Triumph	220		720
1	75	Westgh. New	440	CS	720
1	100	Westgh.	440		1200
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1	150	G.E. NEW .	220	M	580

3 PHASE, 25 CYCLE MOTORS

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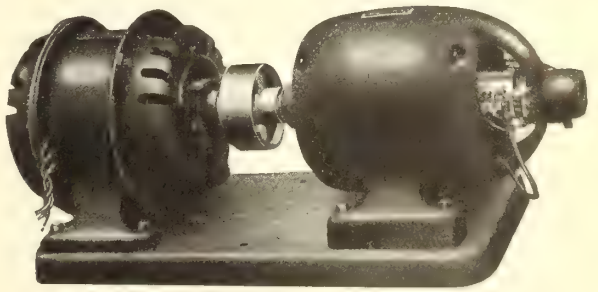
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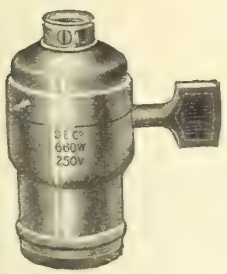
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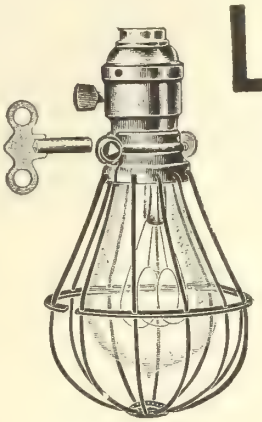
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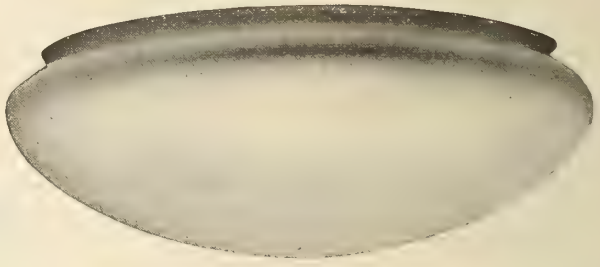
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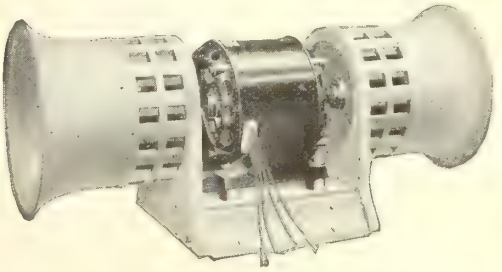
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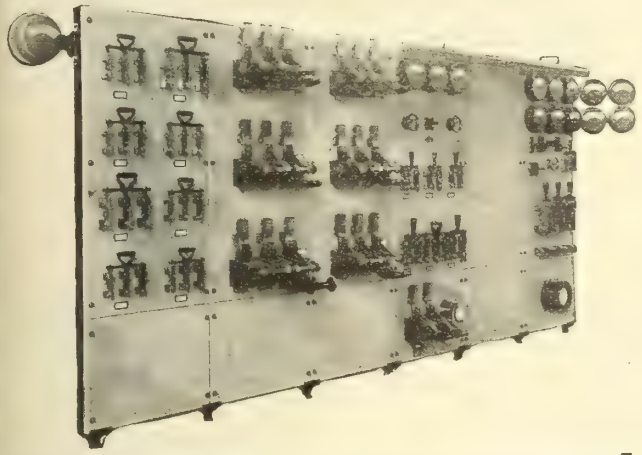
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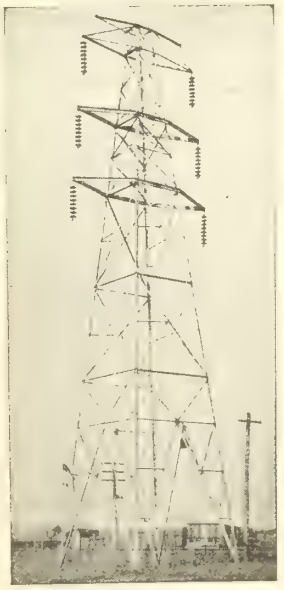
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Tallman Brass & Metal Company

FLASHLIGHTS
Northern Electric Company
Spielmann Agencies Registered

FLEXIBLE CONDUIT
Hatheway & Knott, Inc.
Tubular Woven Fabric Company

FLOOD LIGHTS (Electric)
Crouse-Hinds Company of Canada, Limited.

FUSES
Canadian General Electric Company
Canadian Westinghouse Company
Chicago Fuse Manufacturing Company
Daum, A. F.
Detroit Fuse & Manufacturing Company
Economy Fuse & Manufacturing Company
G. & W. Electric Specialty Company
Hatheway & Knott, Inc.
Moloney Electric Company of Canada
Northern Electric Company
Square D Company

(Continued on page 54)

You Know the Noise!

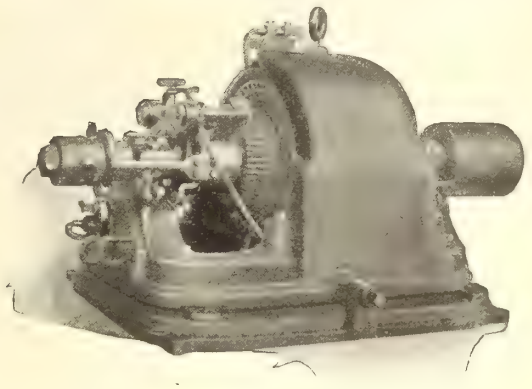
caused by commutators sparking and flashing—the result of undue friction between brushes. This trouble can be cured by fitting your machines with

No-Spark Carbon Brushes

They run smooth, do away with the continual cleaning, replacing and resetting because these brushes are frictionless and self-lubricating. Try "NO SPARK" Brushes. Other engineers are enthusiastic over them. Why not you?

CALEBAUGH
Self-Lubricating Carbon Co.
1503 Columbia Ave., PHILADELPHIA, Pa.

The Prototype Motor



The first successful singlephase motor was Wagner-Quality. Backed by years of engineering and manufacturing experience, the Wagner Singlephase motor of today is the paramount motor.

May we send you Bulletin 1113?

Wagner Electric Manufacturing Company
of Canada Limited-Montreal
Power Bldg., Montreal. 347 Adelaide St., W., Toronto
517

BOXED FIXTURES

Just what you have been looking for MR. JOBBER and DEALER

Our new line of complete fixtures. Each fixture packed complete to a box, and sealed at our factory, eliminating **DAMAGED FIXTURES** and **MISSING PARTS**, ensuring safe arrival of good clean stock to your customer. Convenient for jobbers where stock has to be repacked and reshipped.

Ready for shipment June 15, large circular showing this complete line will be mailed to every customer at an early date. Look for it.

On June 1st, we will Move to Our New Showrooms and Sales Department, at 80 King Street West, Toronto, where we will be glad to welcome all old and new customers.

W. H. BANFIELD & SONS, LTD., TORONTO, CAN.

Largest Manufacturers and Jobbers of Electrical Fixture Parts and Fittings in Canada

City Sales Office: 120 Adelaide St. W. **Adel. 104** **General Office and Factories: 370-386 Pape Ave.**

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Square D Company

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Jefferson Glass Company

INSPECTION ENGINEERS
Allen Inspection Company
Canadian Inspection and Testing Laboratories

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Northern Electric Company

INSULATION
Redmanol Chemical Products Company

INSULATION (Hard Fibre)
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Mica Company of Canada
Northern Electric Company
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INSULATING CLOTH
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Electrical Maintenance & Repairs Company
Hatheway & Knott
High Efficiency Lamp Company
Lincoln Electric Company of Canada
Moloney Electric Company
Northern Electric Company

LANTERNS (Electric)
Duncan Electrical Company
Spielmann Agencies, Registered

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Canadian General Electric Company
Electric Service Supplies Company
Moloney Electric Company of Canada
Northern Electric Company

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Acme Stamping & Tool Works, Limited
Canadian General Electric Company
Northern Electric Company
Ohio Brass Company
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Steel Company of Canada, Limited
Steel City Electric Company

LIGHTING STANDARDS
Adams-Bagnall Electric Company
Canadian General Electric Company
Joyner, Limited, A. H. Winter
Northern Electric Company
Pringle, R. E. T.

LOCK AERIAL RINGS
Acme Stamping & Tool Works, Limited

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Chamberlain & Hookham Meter Company
Ferranti Electrical Company of Canada
Great West Electric Company
Northern Electric Company
Packard Electric Company
Rose & O'Hearn

MICA
Chicago Mica Company
Kent Bros.
Mica Company of Canada

MOTORS
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Canadian General Electric Company
Canadian Westinghouse Company
Canadian Vickers
Century Electric Company
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Robbins & Myers
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Sachsenmaiere Company, Geo.
Thomson Company, Limited, Fred
Toronto & Hamilton Electric Company
Wagner Electric Mfg. Company of Canada

NICKEL
International Nickel Company

OFFICE FURNITURE
Canadian Office & School Furniture Company

OUTDOOR SUB-STATIONS
Moloney Electric Company of Canada

OVERHEAD MATERIAL
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PANEL BOARDS
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McGill Manufacturing Company
Spielmann Agencies, Registered.
Standard Underground Cable Co. of Canada

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Electric Testing Laboratories, Inc.

PATENT SOLICITORS & ATTORNEYS
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Fetherstonhaugh & Hammond
Marion & Marion
Ridout & Maybee

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Acme Stamping & Tool Works, Limited
Ohio Brass Company

PIPE LINES
Boving Hydraulic & Engineering Company

PLUGS
Benjamin Electric Manufacturing Company
Crouse-Hinds Company of Canada, Limited.
Hatheway & Knott, Inc.
Pringle, R. E. T.

POLES
Brown Company
Lindsley Bros. Company
Northern Electric Company

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Hubbell Company, Harvey
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RODS
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Northern Electric Company
Pringle, R. E. T.

SOCKETS
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Canadian General Electric Company
Crouse-Hinds Company of Canada, Limited.
Duncan Electrical Company
National Metal Molding Company
Northern Electric Company

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CANADIAN PORCELAIN CO.

LIMITED

HAMILTON - CANADA

Manufacturers of High and Low Tension Porcelain Insulators



Aboard Uncle Sam's battle ships too stringent care cannot be taken to prevent overloads and short circuits reaching the electrical equipment. This is effectively safeguarded against by the use of

ECONOMY renewable FUSES

No one can question for a moment that safety is the first consideration in the fusing of these circuits. What greater assurance could be offered of the accuracy and all-around dependability of Economy Fuses?
Now weigh the fact that ECONOMY renewable FUSES and "Drop Out" Renewal Links cut annual fuse maintenance costs 80 per cent. A single order recently shipped to one Navy Yard saved the government over $76,800.00. Smaller users enjoy the same proportionate saving.
Order from your electrical dealer. Write for Catalog 20.

An inexpensive little "Drop Out" Renewal Link restores a blown Economy Fuse to its original efficiency.

ECONOMY FUSE & MFG. CO. OF CANADA, LIMITED
UNITY BUILDING - MONTREAL

Manufacturers in Canada of S & B High Potential Fuses—to 150,000 Volts.

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Jordan Bros., Inc.

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Northern Electric Company

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Onward Manufacturing Company
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VARNISHES
Spielmann Agencies, Regd.

VIOLET RAY APPARATUS
Branston & Company, Chas. A.

WASHING MACHINES
Onward Manufacturing Company

WATER POWER MACHINERY
Boving Hydraulic & Engineering Company
Smith Company, S. Morgan

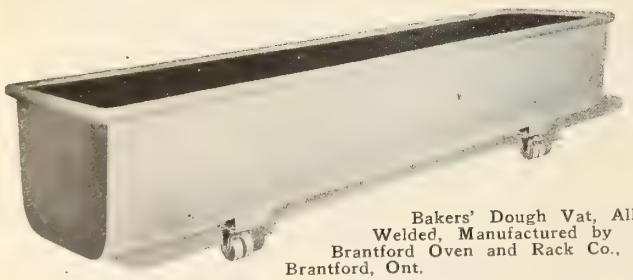
WATER WHEELS
Canadian Allis-Chalmers Company

WELDING EQUIPMENT
Lincoln Electric Company of Canada

WIRE
Boston Insulated Wire & Cable Company, Ltd.
Canada Wire & Cable Company
D. & W. Fuse Company
International Nickel Company
Northern Electric Company
Phillips Electrical Works, Ltd., Eugene F.
Standard Underground Cable Company of Canada, Limited.

WIRING DEVICES
Canadian General Electric Company
Crouse-Hinds Company of Canada, Limited.
Hatheway & Knott, Inc.
Northern Electric Company

OXY-ACETYLENE WELDING & CUTTING



Bakers' Dough Vat, All Welded, Manufactured by Brantford Oven and Rack Co., Brantford, Ont.

Economy and Efficiency in Your Manufacturing

Increased Profits in Your Sales

Not only in most cases is the Process of Manufacturing Products of this nature simplified by the Oxy-Acetylene Process, which tends to greater production and a saving in cost, but the welded joint, being perfectly homogeneous and with no inherent weakness, entails no risk of leakage at the seams when subjected to extremely hard use. After machining, it is impossible to detect the joint, which contributes to the higher quality of the article produced and adds to its commercial value.

The applications of the Process in your Industry are manifold.

WRITE FOR PARTICULARS

L'AIR LIQUIDE SOCIETY

Manufacturers, in Canada, of all requisites for the Oxy-Acetylene Process.

TORONTO. MONTREAL. WINNIPEG. HALIFAX.

LINCOLN MOTORS

More Power To You

That's just what it would mean if the metal working plants in your territory could be given only a glimpse of the possibilities in electric arc welding.

There isn't a piece of apparatus made which will return you more power sales for little effort than

The Lincoln Arc Welder

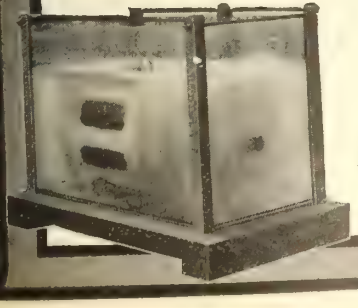
Every steel foundry, forge shop and stamping plant in your territory — every plant where metals are joined or breakage and wear of metal repaired—50 per cent. of the shops where acetylene is used—are prospects for electric arc welding.

You do not have to sell them, just interest them and we will send our welding engineers to go over the proposition and close the sale.

Write us for literature and information on any welding job you run across.

Lincoln Electric Co.

of Canada, Limited



Head Office
311-312 Kent Building
TORONTO
Ontario

Branch Office
MONTREAL

The Continued Success

of

Colonial Copper Clad Wire

TRADE C.C.C. MARK

is due to the perfection and continued supremacy of weld between the copper and steel, and an expert knowledge of and skill in the production and uses of high grade electric wire and cable products.

For over 10 years C.C.C. Wire has maintained its supremacy. During that period it has been continuously produced according to the same methods in millions of pounds yearly for the most exacting buyers of wire products for electrical uses.

Colonial Copper Clad Wire has been produced continuously for a longer period and in larger quantities than the combined quantities and periods of manufacture of all other past or present competitive products. It has stood the acid test of time in service tests and unbroken continuity of manufacture as no other wire has done.

It is probably not overstating the case to say that Colonial Copper Clad Wire is the only copper clad wire that has been produced in which a thorough weld is secured between the copper and the steel—a weld made by pressure between two accurately centralized, previously treated and prepared plastic metals, on exactly the same principle that the blacksmith welds his two pieces of iron into a single piece of equal or greater strength than the original bars. The most exacting tests of twisting, pulling, hammering, heating, and quenching, immersion in acids, etc., fail to indicate that the union between copper and steel in Colonial Copper Clad Wire is not of a strength substantially equal to the strength of the copper itself. A weld of this sort must not be confused with a union where the metals are merely melted together.

Do not be misled, but write for Bulletin No. 202 for further information about C.C.C. Wire.

Standard Underground Cable Co. of Canada, Limited

Hamilton, Ont.

Montreal - Toronto - Hamilton - Seattle

Westinghouse
Electric Ranges



Type 3-19 Automatic Electric Range with Clover-Leaf Set and Cooker Pot in Small Oven, and Turnover Toaster attached.

These ranges have the exclusive economical feature of full automatic control by attached clock and thermostat.—They are strongly constructed throughout, all parts being of metal.—For the ovens the best, practical, rust-resisting metal known is used, covered on the inside with an aluminized finish which is a further protection against rusting.

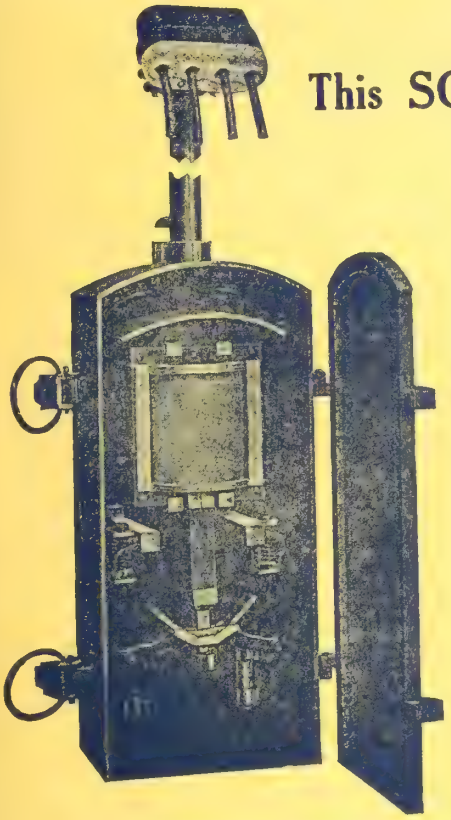
The ovens are heavily insulated with the finest grade of rock wool, which reduces the escape of heat to a minimum.—A specially designed heat distributor produces an even temperature.

All parts of the range are readily accessible. Everything can be removed from the ovens, and the ovens flushed with water with no evil effects.

Our Catalog 8-D describes the full line—Send for a copy

Canadian Westinghouse Co., Limited, Hamilton, Ontario

Toronto	Montreal	Ottawa	Halifax	Ft. William	Winnipeg	Edmonton	Calgary	Vancouver
Traders Bank Bldg.	52 Victoria Sq.	Ahearn & Soper Ltd.	105 Hollis St.	Cuthbertson Block	158 Portage Ave. E.	211 McLeod Bldg.	Grain Exchange Bldg.	Bank of Ottawa Bldg.



This SOLENOID SWITCH has been adopted by the Hydro Electric Commission

They use it for

STREET LIGHTING

Now the fact that it is used by the Hydro-Electric Commission is proof that it is all we claim for it. It certainly is not an experiment. by the fact that it is giving efficient service in many towns throughout Ontario, as well as the other provinces.

No springs, swivels or other complicated mechanisms to give trouble. They close magnetically and are opened by gravity assisted by the tension of the laminated copper contact. All arcing is taken up on the carbons.

Increase the efficiency of your system and decrease the cost of installation by using our Type 17 H.E.P. Solenoid Switches, which are suitable for any frequency on multiple circuit or D.C. Series circuit.

Write for complete descriptive particulars

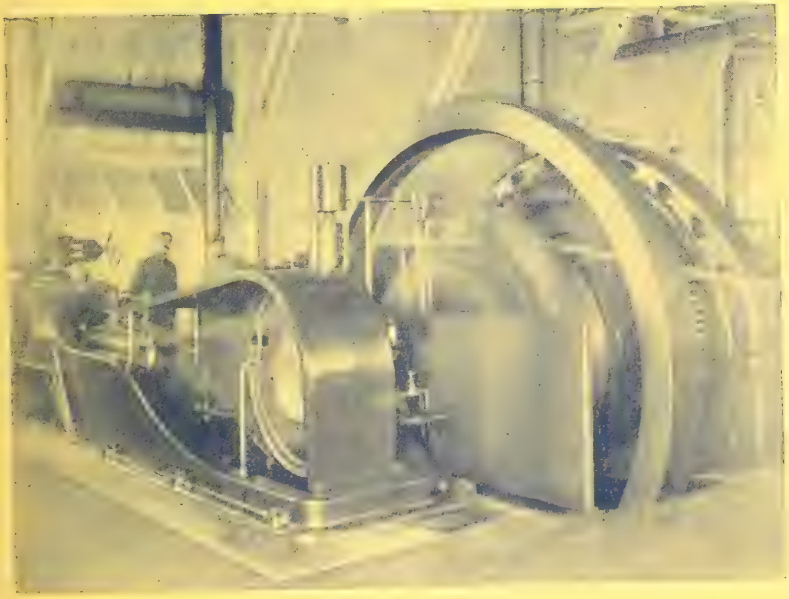
The Electrical Maintenance & Repairs Company, Limited

Phone Adelaide 902-903

162 Adelaide Street West TORONTO

Nights Beach 1723 1930

25 Cycle Engine Generator Sets For Sale



1—250 KW.
1—300 KW.

25 Cycle
3 Phase
Westinghouse
Generators
Direct
connected to
McIntosh &
Seymour
Cross Compound
Gridiron Valve
Engines 150 R.P.M.

These units were in use only—300 K.W. three months, and 250 K.W. seven months, and are in first class condition.

Write for further particulars and quotations

Power Plant Equipment Co., Dominion Bank Bldg. Toronto, Ont.

ELECTRIC REPAIRS

We can keep you running
while we make your repairs

FRED THOMSON CO., LIMITED
7-13 ST. GENEVIEVE STREET
MONTREAL

G&W ELECTRIC SPECIALTIES

The Essential Details of G & W DISTRIBUTION BOXES

are very carefully perfected

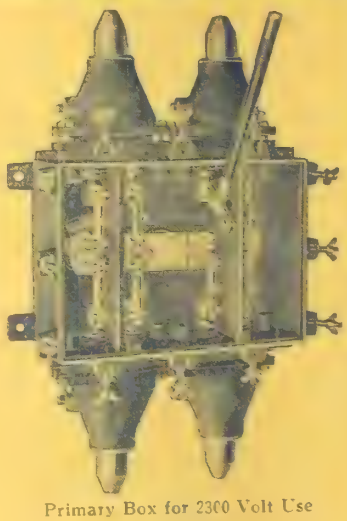
In the primary box illustrated, switch blade action is combined with bolted contact efficiency
Unit cable potheads with ample compound space make an easy installation without sacrifice of safe, permanent cable end insulation.

The entire box is lined with insulating material—all bolt heads, etc., are covered and different polarities are thoroughly barriered.

In the secondary box double U clips give better contact alignment than would a single U clip.

The unit cable potheads attach at an angle, gaining roominess without using excessive wall space.

The line of this material is complete, offering constructions suitable for all conditions.



Primary Box for 2300 Volt Use

Let us quote you on your requirements



Secondary Box for Low Tension Use

G & W ELECTRIC SPECIALTY CO.
7440-52 So. Chicago Ave. CHICAGO, U.S.A.

A. H. Winter Joyner, Ltd., 100 Wellington St. W., Toronto.
A. H. Winter Joyner, Ltd., 17 St. John Street, Montreal.
Bentz-Richardson Co., Ltd., 592 Notre Dame Ave., Winnipeg.
General Supplies, Limited, Calgary and Edmonton.

VOL. XXVII No. 12 TORONTO, JUNE 15, 1918.

Electrical News

Generation, Transmission and Application of Electricity

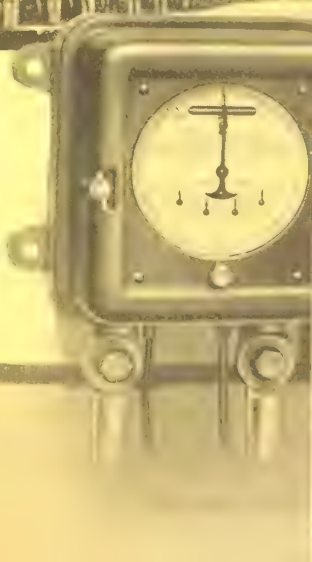
A "Battery" of Bread Wagons Operated on the Amperehour Principle

SANGAMO
BUILT LIKE A WATCH



The Amperehour Meter is the most convenient and one of the most reliable methods of determining the state of charge of the battery. It is the **only reliable means for automatically terminating the battery charge** when the proper amount of overcharge has been given the battery.

That is why the Purity Bakery of Minneapolis—whose equipment is shown above—and thousands of other important users of storage batteries for electric vehicles, trucks, railway train lighting equipment, farm lighting plants, wireless telegraphy, etc., are using Sangamo Amperehour Meters. The Amperehour principle adds materially to the life of the battery because it prevents destructive over-charging. Let us send you full details.



Sangamo Electric Company
of Canada, Limited

Toronto Montreal

HUGHES
Electric Ranges

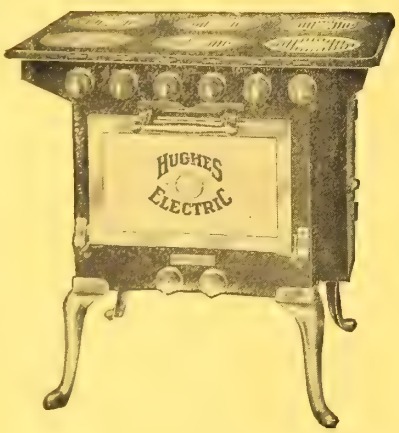


No. 50

HUGHES "50" ELECTRIC RANGE

This is one of the most popular styles of ranges on the market. Ideal for homes, suitable for medium or large size family, also for Clubs, Church Kitchens, etc.

Features, 4-burner cooking surface, 2-burner oven, warming compartment, outside warming shelf, lower outside shelf. Finish either plain or nickled with white enamel splashers.



No. 48

HUGHES "48" ELECTRIC RANGE

Extremely handy; designed for large families, boarding houses, restaurants, hotels, clubs, etc., where a greater cooking capacity is required in a small space.

Features, 6-burner cooking surface, 2-burner oven. Finish either plain or nickle plated.



No. 44

HUGHES "44" ELECTRIC RANGE

A very popular range because it uses little floor space and has elevated oven, exclusively for families of average size.

Features: 4-burner cooking surface, 2-burner oven, lower outside shelf. Finish either plain or nickle plated.



No. 27

HUGHES "27" ELECTRIC RANGE

The most desirable Range for small or medium size families with limited kitchen space.

Features, 2-burner cooking surface, 2-burner oven, elevated outside warming shelf. Finish either plain or nickle plated.

Electricity Makes Cooking Scientific and Economical

SCIENTIFIC—because they have introduced and adopted, virtually, every fundamental improvement in the development of the modern electric range—the most complete line of electric cooking apparatus in the world.

ECONOMICAL—because of economy of current, of food, of time and trouble. The HUGHES ovens are so constructed as to make it possible to turn off the current long before the food is cooked, because it does not shrink or dry out the food it cooks, hence an appreciable saving in market bills.



No. C-18

HUGHES RANGES are sold with a year's guarantee against defects electrical and mechanical, backed by the reputation of their makers. They are without doubt the best and most economical electric ranges on the market.

Awarded GOLD MEDAL, Panama Pacific International Exposition, 1915.

Tested and approved by the Underwriters' Laboratories of the National Board of Fire Underwriters—and also by Good Housekeeping Institute.

Write our House nearest you for further information as to literature, prices, etc.

HUGHES "C-18" ELECTRIC RANGE

It is solidly constructed of steel and cast iron, occupying floor space of only 17 x 25 inches, compact, neat, most suitable for light cooking. Finish plain black enamel.

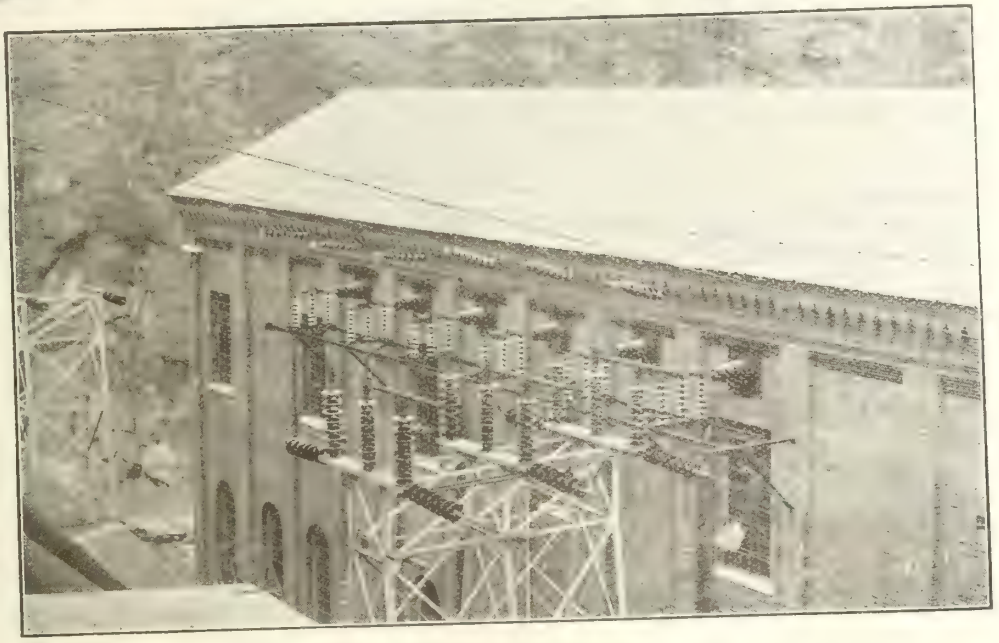
Northern Electric Company
LIMITED

MONTREAL
HALIFAX
OTTAWA

TORONTO
LONDON
WINNIPEG

REGINA
CALGARY
VANCOUVER

O-B PRODUCTS



MODERNIZED INSULATORS

Harmonized design and manufacture have made possible the uniform reliability of O-B Porcelain Insulators.

The designs result from a complete understanding of transmission problems and a knowledge of the possibilities of well-made porcelain.

The manufacturing methods came from sure footed progress—ideas tempered by specialized experience.

There is a specific type of O-B Insulator for every requirement—usual or unusual—of station and line.

The Ohio Brass Company

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FLEXTUBE

The non-metallic, flexible conduit you should buy—for economy's sake and for your wiremen's sake. FLEXTUBE samples and descriptive Bulletin No. 151 sent on request.

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Double Compounding  **Double Value**

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(Reg. Can. Patent Office)

OF COURSE!

The Original Single wall flexible non-metallic conduit.

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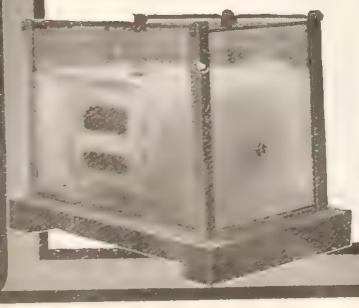
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Lincoln Electric Co.

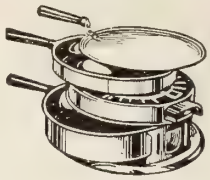
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Every occasion that prompts gift-purchasing is an opportunity for the "Premier" dealer.



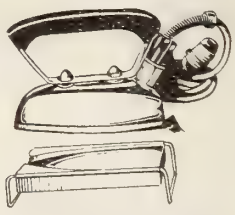
IN the past a good many electrical appliances have been bought rather thoughtlessly — by folks who wanted merely the convenience that electricity brings. But there will be less of this kind of buying in the future. There will be more inquiring into merit, into design, construction, finish. That's the thought most dealers have in mind when adopting the new "Premier" line. They realize that in the "Premier" organization are men who have grown up with the industry; men who are known throughout the trade as progressive. At a glance they know that "Premier" appliances are "all that the name implies." And the advertising campaign now running is but the forerunner of our effort to warrant their faith in becoming "Premier" dealers. You can't afford to judge the "Premier" by your previous experience of electrical appliance makers. Get in touch with the "Premier" men themselves, know the goodness of "Premier" appliances, learn the handsome margin of profit they allow. Act on the impulse—write now.

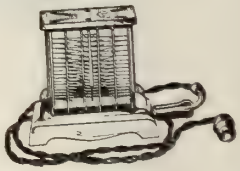
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Pembroke, Ontario

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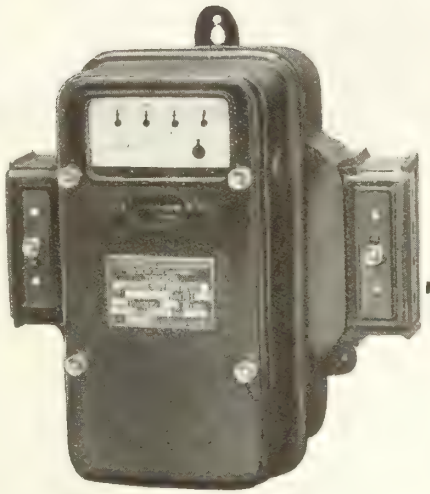


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"All That the Name Implies"

Absorbs the Shock

Our special C. & H. Poly-Phase Meter is safe because it is fitted with new double terminal blocks that absorb the shock and reduce the danger of accident resulting from overloaded wires and from surge conditions during lightning storms.



This meter also has more inside room for the connections, and the three or four lines are carried straight through the meter from the left to right. In every respect this C. & H. Poly-Phase is a Safety Meter, and is undoubtedly the one to select for Installation on Long Distance Transmission.

C&H Poly-Phase The Safety Meter

The Company's guarantee goes with every instrument. The new Poly-Phase is as near perfect as it is possible for a meter to be.

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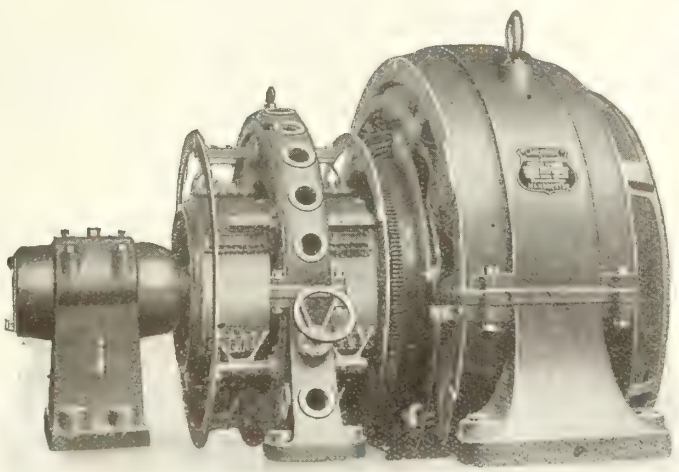
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340 University Street, MONTREAL

We have a large stock of motors up to 100 H.P. in Toronto ready for immediate delivery

The "Lancashire" Ball Bearing Induction Motor and "Patent Reversing Drive for Metal Planers," will repay investigation.

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1000 H.P. Variable Speed Motor for Direct Coupling to Tyre Rolling Mill.

Accidents will happen, but a complete stock of spare parts and well equipped repair shop ensure users of "Lancashire" machines, minimum inconvenience from such breakdowns.

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Useful in the Shop and Laboratory for the Measurement of Resistance. Adapted for Fault Locations in Telegraph and Telephone Lines and Cables.

The Type S Bridge is a thoroughly practical instrument for shop and field use. Being complete in every detail it is ready at all times for immediate use. It is easily portable, its weight being but 8 pounds. The precision of adjustment of its coils (Rheostat 1/10 per cent., Ratio 1/20 per cent.) insures accurate measurements. The galvanometer, the weakest element of such an instrument, is unusually rugged. It is a separate element and may be removed for examination or repair by taking out two screws. The battery is of the ordinary "flash light" type, and renewals may be procured practically everywhere. The price is $66.25 net, f.o.b. Philadelphia, boxed for shipment.

Bulletin No. 530 describes this instrument.

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Electrical Measuring Instruments

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A high-class interior construction conduit of the enamelled type, proof against acid or other corrosive agents.

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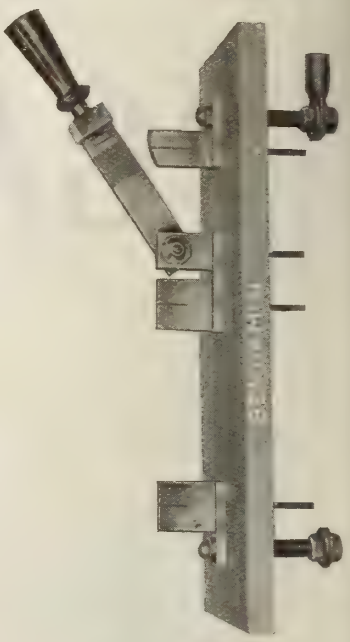
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"LORICATED"

Benjamin "All Copper" Made-in-Canada Knife Switches



Benjamin "All Copper" Knife Switches are built in accordance with the Underwriters' latest rulings and recommendations.

Great care is exercised in their construction and the materials used are of highest quality.

The current-carrying parts are made from pure hard drawn copper, and slate is especially selected for our use.

The fibre used is selected with great care, and is especially treated before being made into cross-bars, and other insulating parts.

Our switches are so built that they will easily carry a heavy overload, and much attention is given to the details of construction of jaws and hinges, so that arcing will be at a minimum, and the make and break as nearly perfect as possible.

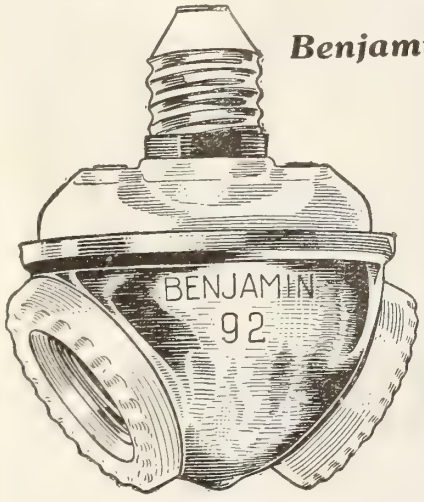
All the elements of switch construction have expert attention, and the workmanship is high class in every respect, insuring for our products long life and great carrying capacity..

We are in position to furnish all kinds and types of special switches for service boxes, switch-board and other work.

"MADE-IN-CANADA"

Electric Lighting Specialties

Including Plug Clusters, Attachment Plugs, Sockets, Shades, Etc.



Benjamin Plug Clusters— Two-Way Plug

The easiest, quickest and best way to obtain two outlets from one socket. No extra wiring, or great expense. Just simply screws into the socket, like a lamp. Also supplied for 3 and 4 outlets.



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Are scientifically designed to give the best results in illumination, and special attention is also given to the quality and finish to ensure durability.

Benjamin Sockets



Standard Brass-Shell Sockets as shown in the accompanying illustration are one of our specialties. Full line includes Twin Sockets, Mogul Base Sockets and "Benco" highly-insulated, high-duty sockets.

Benjamin Swivel Attachment Plugs



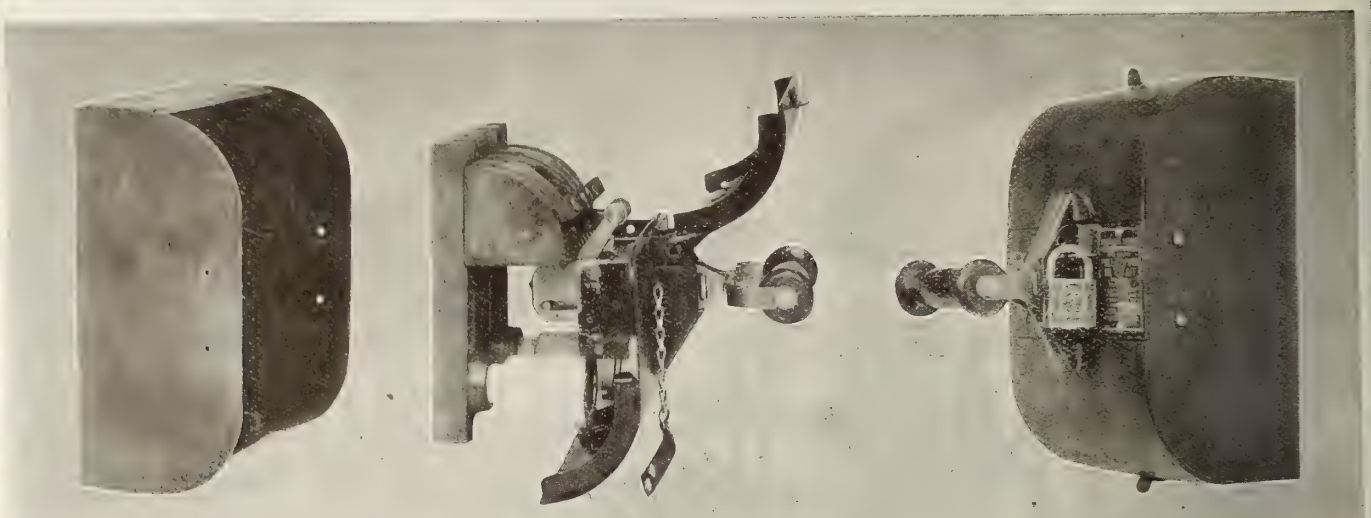
An ingeniously devised swivel shell makes it possible to affix or remove the plug quickly without twisting the cord.

The Benjamin Electric Mfg. Co. of Canada, Ltd.

11-17 Charlotte Street - TORONTO

MAKERS OF Benjamin PRODUCTS OF CANADA


Quality
Service
STEEL & IRON
PRODUCTS
OF
Every Description
THE
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25 Reasons

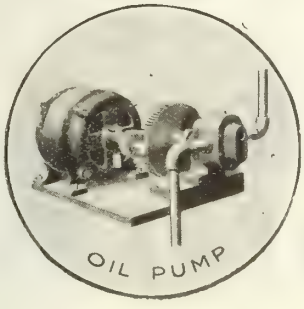
The "Ten Thirty Eight" Switch for Starting Small A-C Motors

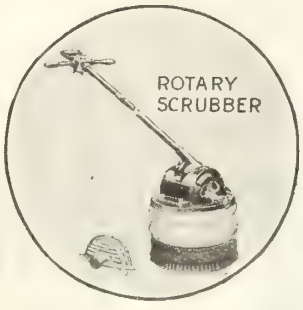
1. It is enclosed in steel.
2. Wood handle is non-conductive.
3. Fits the hand.
4. Covers open for inspection.
5. Covers locked during use.
6. Switch locked during non-use.
7. Cover won't open if switch is closed.
8. An accidental push will open the switch.
9. A pull closes it.
10. Four screws hold entire front of switch, including covers.
11. Protective plugs prevent continued overloads on the motor.
12. A fusible link is the only supply part necessary.
13. Links same for all switches.
14. Switches same for all motors.
15. The plugs are the only variable unit and can be furnished for AC Motors up to 5 h.p.
16. Links cost less than fuses.
17. And can be carried in vest pocket.
18. Switch has moulded compound barriers.
19. Approved by fire underwriters.
20. Holes drilled for wall mounting.
21. Arranged for conduit wiring.
22. Thousands in use.
23. Thousands more on the way.
24. You can order them at any place where they sell C-G-E motors.
25. And the price is low. Ask our nearest agent or get prices on quantities from our nearest office.

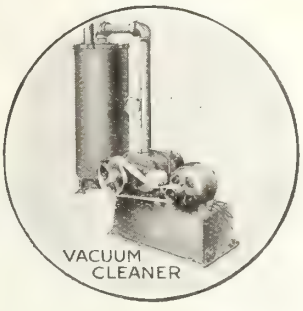
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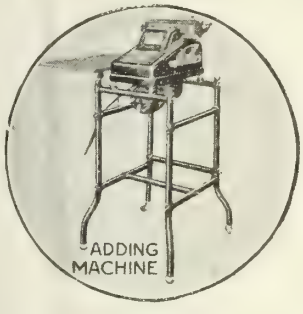
Wayne Fractional Horse Power Motors

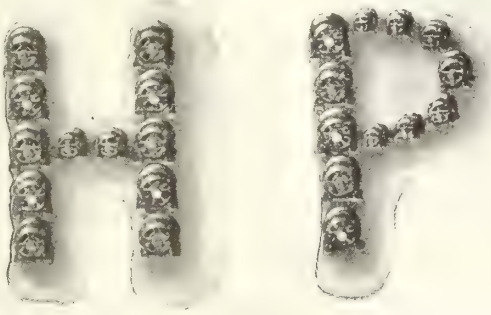


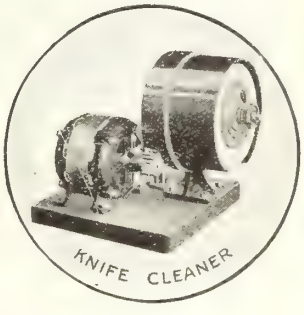




WAYNE FRACTIONAL



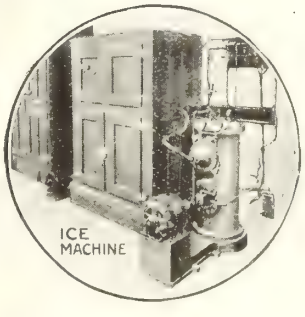




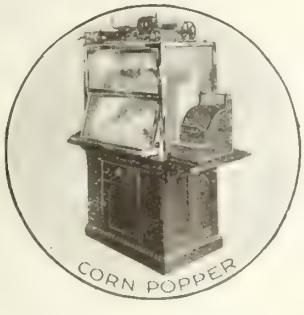
MOTORS



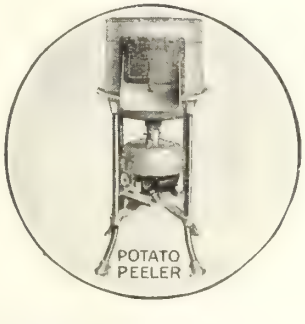
furnish the most desirable form of motor power for mechanisms requiring from 1/200 to ¾ H. P. The manufacturer of the motor driven device equipped with these Motors enjoys a sense of security because of the service he can guarantee from his machine



The standard line probably meets your requirements
If it does not, our engineers are at your service.







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LIMITED

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Stability and Efficiency

are prime factors in development of Water Power in these days of intense activity.

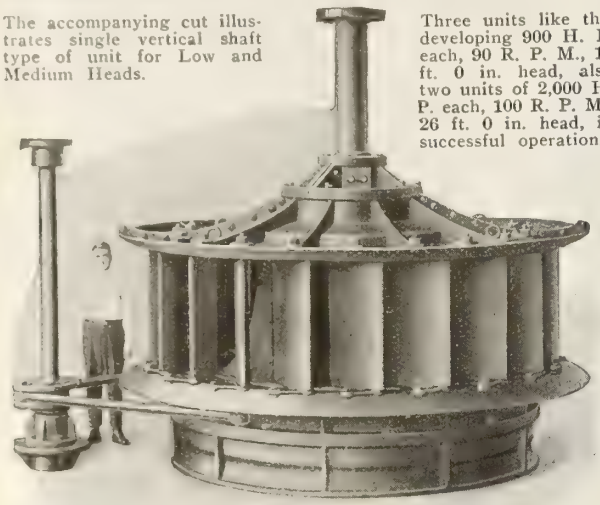
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SMITH HYDRAULIC TURBINES

are being installed in the "PLANTS THAT COUNT"

The accompanying cut illustrates single vertical shaft type of unit for Low and Medium Heads.

Three units like this developing 900 H. P. each, 90 R. P. M., 15 ft. 0 in. head, also two units of 2,000 H. P. each, 100 R. P. M., 26 ft. 0 in. head, in successful operation.



Write Department "N" for Bulletin of Designs and Useful Data for Hydraulic Development.

S. Morgan Smith Co., York, Pa.

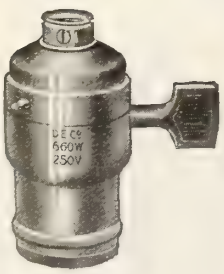
H. B. Van Every, Canadian Representative, 405 Power Bldg., Montreal

660 Watt Brass Sockets

1/8" and 3/8" Caps

—

Key and Keyless



Approved

—

Snap Cap

No. 660

Manufacturers

The Duncan Electrical Company, Limited

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Are you interested in the remarkable development which has been going on in the

I-T-E CIRCUIT BREAKER

during the past year or two?

The scope of our work enables us to supply **practically standard breakers for special service.** We submit that the circuit breaker art of the world is what we have made it. A search of the Patent Office records will prove this statement, or an easier way might be for you to look at any recent notable installation.

Take the Equitable Building in New York, for example, or the Lumber Exchange and the Conway Building of Chicago, or the wonderful equipment of the Ford Motor Company.

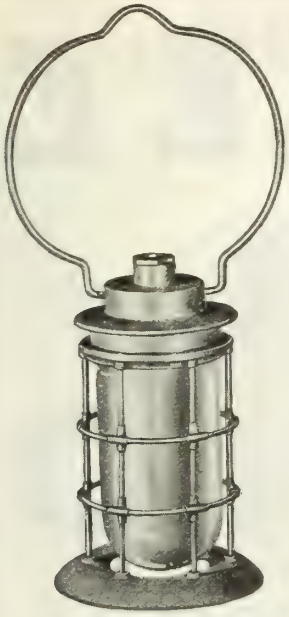
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Toronto, Ont.

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Catalog No. 2704

One of the many

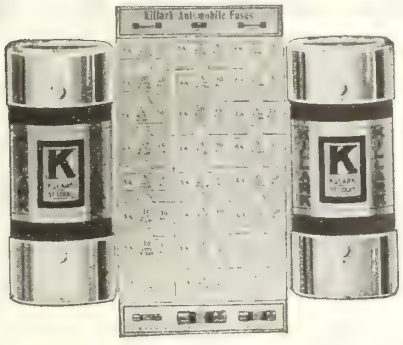
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Offer substantial profits to every dealer



The right fuse for every make of car and motor cycle

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Pole Type Transformers

Single and Three Phase

HIGH EFFICIENCY— LOW CORE and COPPER LOSSES

Write us for Prices and Delivery before ordering elsewhere.

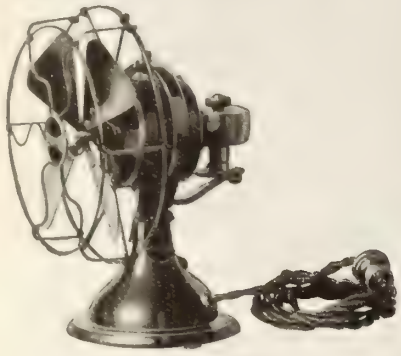
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Catalogue No. 155 8 in.

A Popular Fan
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A Popular Price

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Catalogue No. 150—8 in.

The Fan Season is here!!!! Have you secured your supply of fans? The above fans can be supplied in two types:—Catalogue No. 150 is an 8-in. Universal, Straight Blow, and Catalogue No. 155 is an 8-in. Universal Oscillating. For office or household use the above types are desirable fans (at a popular price). Shipments can be made from stock if ordered at once. Write for prices now.

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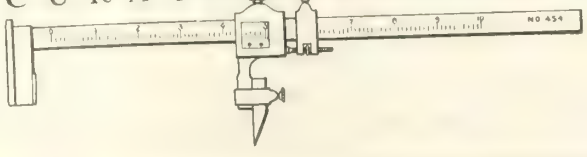
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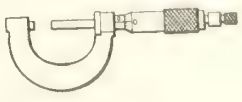
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No Reason for Hazard in Farm Lighting Plants

Mr. A. O. Fisher, provincial fire commissioner, of Regina, is quoted as stating that the public favor with which the small farm and rural electric light plants are meeting has resulted in the creation of a new fire hazard and that his department has been forced to give consideration to the best methods of preventing extensive fire loss throughout the province by the introduction of this new method of rural lighting.

It is unfortunate if the impression should get abroad throughout the farmers and other rural residents of Saskatchewan or any other province of the Dominion, that electric light plants are dangerous either to life or property. If properly installed, they cannot be said to constitute any hazard whatever. As a matter of fact, gasoline engines have been installed for many years in the barns and barn basements of many farmers, constituting a very dangerous hazard, with surprisingly few disastrous results. The explanation doubtless is that farmers have been warned of the possible dangers and, being naturally of cautious disposition they have taken the necessary care. Farmers, in general, do not carry as much insurance as they might and rarely think of adding to the amount when their barns are temporarily filled with grain or stock. On this account they have learned to be doubly cautious. Under these circumstances there seems no reason whatever why rural electric plants should constitute any hazard, and it can only be by the grossest carelessness in installation or operation that such would be the case.

It is just possible that in their endeavor to keep the cost of the plant and the installation down to the lowest possible figure, certain makers are failing to use ordinary precautions. Possibly also, they are making light of the dangers inherent to electricity. The former is something that each government should be watchful of. As much care should be taken in the installation of an electric plant in a rural home as is required in a city home. Nor can we see that manufacturers or dealers in these small plants can hope to gain anything by minimizing the possibilities of danger. Much better that they should explain the possibilities and at the same time make it plain that these possibilities can be removed beyond the shadow of a doubt by the use of common sense and every-day caution.

The introduction of the isolated electric lighting and power plant into farm and other rural homes is one of the greatest blessings of the present age, and it would indeed be a great pity if any errors in judgment should interfere with the steady progress which is being made toward the more general use of such equipment.

Labor Unions Do Not Hesitate To Tie Up Industries of a Great City

Street railway transportation in the city of Winnipeg, Man., was tied up for three days during the week of May 18th, owing to 1,000 employees of the Winnipeg Electric Railway Company striking, in sympathy with civic employees who struck for a raise. The strike, which involved 15,000 workers in over a dozen unions was the most disastrous in the history of the city and from the time that the first civic employees walked out until a settlement was effected was over a month.

The city was without street car service on one of the most important holidays of the year, Victoria Day, May 24th, being the first summer holiday, and the tieup, while it only lasted three days, caused inconvenience to thousands of workers, who living in the outlying districts, had to walk in many cases as much as six miles to get to their places of employment. Hundreds of owners of motor cars co-operated at the request of the civic authorities, and at the rush hours a continuous string of cars could be seen passing up and down the busy thoroughfares.

The street car men walked out on the morning of May 22nd and a settlement was reached at noon of the 25th. The settlement was effected as a result of the visit of Senator Gideon Robertson, of the Dominion Government, who acted as a mediator, and who at the time the street car men struck was on his way west. The street car men were called out as a last resort by the striking committee, and this action was considered the trump card.

A magnificent spirit of cooperation was manifested throughout the city in a desire to keep the public utilities running. Society women who did not know the meaning of work manned the telephone switchboards and helped to maintain a service for a week that the operators were out. Girls in railroad offices dropped their pens, donned overalls and hustled trucks when the freight handlers joined the striking unions, and private motor car owners acted as jitney drivers in their desire to assist those to their work who had long distances to travel.

The underlying motive of the strike was not based entirely upon the refusal of the city to grant increases in the different departments, but rather on a point of principle. The city maintained that employees should arbitrate matters of this kind in war time. Labor spokesmen asserted that the life of unionism rested solely upon the right of labor to strike to procure their demands. The thorn in the flesh insofar as the city was concerned was due to the fact that about three-quarters of the firemen who had lately formed a union were the first to go out in sympathy, leaving the city without adequate fire protection. The basis of the agreement finally

reached was that all matters affecting increase in wages should be arbitrated with a strike as the last resort.

The Winnipeg Electric Railway Company suffered the loss of thousands of dollars in revenue as a result of the rolling stock being tied up over the holiday, May 24th came on Friday, and preparations on a large scale had been made for entertaining the public at the various parks. Up until noon of the holiday hopes were held out that an agreement would be reached that day and crews were at the various barns waiting to take their cars out. The walkout from a street railway standpoint was very regrettable owing to the fact that only last winter a new schedule had been drawn up for street car men, providing for increases in all branches, and the best of relations exist between the company and its employees.

The Shortage of Engineers

The United States is now beginning to appreciate one of the difficulties that we have been meeting in Canada for some time, namely the shortage of engineers. In a recent letter from President Wilson to the Dean of the College of Engineering of the University of Michigan, the importance of maintaining the number of engineering students was urged. President Wilson expressed the greatest concern at the falling off in the number of students in the engineering department, stating, "there is not only immediate necessity that as many students as possible should prepare themselves for engineering duties in the army and navy, but it is also of first consequence to the country that there should be an adequate supply of engineers for the period of reconstruction which must follow the war."

It was stated that the attendance in engineering classes since the United States entered the war has fallen from 25 to 35 per cent., and that the graduating classes this year were not more than half their usual size. This approximately represents the condition of Canadian colleges after a year of war, and the United States will do well to prevent the crisis which has arisen in our own universities. The fact is that in the engineering departments of both Toronto and McGill—and doubtless it is so in the other universities—the graduating class reaches the vanishing point before the course is completed. In certain of the courses where the demand for men is greatest, there are no students beyond the second year. Canadians are endeavoring to rectify this serious condition, but the process is slow and it would have been ever so much better if precautions had been taken at an earlier stage in the war.

A Dominion Power Board

The question of an adequate supply of fuel and power for all of Canada is one which has been brought sharply into view as a result of the acute fuel shortages during the past two winters. Certain phases of the situation demand and are receiving immediate action through the Fuel and Power Controllers and the Honorary Advisory Council for Scientific and Industrial Research. The general problem of the fuel-power requirements of Canada is one that the end of the war will not solve. It is not merely a question of looking ahead for a year or two years or for whatever time the present conflict may last, but rather a matter of providing for all time to come.

Canada is recognized as one of the greatest water power and coal countries in the world. No people enjoy to a greater degree the benefit of cheap, dependable hydro-electric power, and none have had this benefit more universally adapted for municipal, industrial and domestic use. Canada's resources of coal are of tremendous extent, but are so located and of such a nature that special problems must be solved before they are made available to their maximum possible extent for domestic and manufacturing purposes. The future progress of the country depends very largely on the development and use of all the available fuel-power resources. To realize this, the Government has formed a Dominion Power Board, comprising nine permanent officials of the various departments, who have become, as a result of their regular departmental work, recognized authorities on varied aspects of the fuel-power problems of the country. This Board has also been charged with the responsibility of co-ordinating all the investigation activities of the Government with regard to fuel-power resources.

The Board has two main functions: (1) the collection of information (i.e., Intelligence Service); and (2) to advise upon the development and use of fuel-power resources of the country (i.e., an advisory body). The Honourable Arthur Meighen, Minister of the Interior, is Chairman of the Board. The members are comprised of the following officials:—Arthur St. Laurent, assistant deputy minister, Department of Public Works; C. N. Monsarrat, consulting engineer, Department of Railways and Canals; W. J. Stewart, consulting engineer, Department of External Affairs regarding International Waters; John Murphy, electrical engineer, Dominion Railway Commission; H. G. Acres, chief hydraulic engineer, Hydro-electric Power Commission of Ontario; O. Higman, chief electrical engineer, Department of Inland Revenue; D. B. Dowling, geologist, Department of Mines; B. F. Haanel, chief engineer, Fuel Testing Division, Department of Mines; J. B. Challies, chief engineer and superintendent, Dominion Water Power Branch, Department of the Interior.

The Electric Club of London

An organization has been formed in London, Ont., known as "The Electric Club of London." The aim of the Club is the mutual assistance and education of its members along technical and commercial lines, standardization of methods and electrical development. Membership in the association is open to all electrical contractors, electrical manufacturers, central stations and electrical jobbers and dealers doing business in the city of London and also to the local inspection department of the Hydro-electric Power Commission.

The officers and members of the Club are as follows:—President, B. W. Wilcox, Benson-Wilcox Electric Co.; vice-president, L. R. Folley, Commercial Electric Co.; secretary-treasurer, A. T. Taylor, Western Ontario Electric Co.; B. L. Baulch, Northern Electric Co.; Thos. Benson, Benson-Wilcox Electric Co.; W. R. Bowley; E. V. Buchanan, general manager, Public Utilities Commission; E. L. Campbell, Western Ontario Electric Co.; F. R. Dark; Frank Gray, The People's Electric Co.; J. C. Ingram; W. B. Legate, Hydro Inspection Department; W. H. Morgan, Canadian General Electric Co.; E. C. Morkin, Stewart & Morkin; J. H. Pollock; W. E. Rider, Hydro Inspection Department; B. E. R. Thomas, Hydro Inspection Department; J. Winegarden, People's Electric Co.; Wm. Stewart, Stewart & Morkin.

Employment for the Blind

Among other firms who are using employees that have been deprived of their sight, is the Westinghouse Electric & Mfg. Co. The particular class of work for which blind men and women show the greatest aptitude is the taping of coils, and at the present time the company have seven persons employed in this way. To date the quality of the work the blind employees turn out is quite satisfactory, but it is taking them a little longer than ordinary to get up their speed; this is only natural. A few issues ago we reported on a similar venture by the Crocker-Wheeler Co. It would appear from the satisfactory results obtained from the experiments already carried out that employment in this direction will be available for large numbers of returned soldiers.

The Overseas Distribution of Engineering Equipment and Appliances*

By Leonard Andrews, M. I. E. E.

Experience has shown that the country which carries out any original engineering work abroad usually secures the bulk of the subsequent trade of that country, created by the industries thus established. The British Empire owes its present industrial position to the fact that for many generations this country has been the recognised engineering workshop of the world, though in recent years Germany has made special efforts to undermine Great Britain's long-established lead. It is, therefore, a matter of the greatest national importance that British engineering industries should be fostered and developed to the fullest possible extent, and that, if necessary, State funds or credit should be applied to this purpose.

All who have visited engineering works in other countries —particularly in the United States of America and in Germany—must have been impressed by the fact that, as pure engineering craftsmen, British artisans can more than hold their own with any and all competitors, but that as an economic distributor this country has much to learn both from the United States and from Germany. Great Britain's superiority as a producer of engineering appliances is fully recognised by her competitors, and it would almost appear that both Germany and America—having recognised the strength of this country's position as a producer—decided to concentrate their attention upon improving distribution, and have thereby attained an exceedingly high state of efficiency in that particular respect.

Mere efficiency of production is, comparatively, of little value unless combined with efficiency of distribution. As many of the problems associated with overseas trade are so closely analogous to the difficulties which have been successfully overcome in distributing electrical energy, the past experiences of electrical engineers should enable them to render valuable assistance to the executive officers of the various organizations which at the present time are devoting so much attention of the improvement of British foreign trade.

The attitude of those manufacturers who cater only for trade f.o.r. their own works may be compared with that of a power-plant superintendent who only concerns himself with efficient production at the main bus-bars, and assumes that all questions relating to distribution are beyond his province; and who, moreover, considers that a reliable low-priced supply should be sufficient inducement to the consumer to make his own arrangements for the distribution and application of the service outside the generating station.

Naumann, in his "Mittel-Europa," says:—"In the last 20 years our German industries have assumed a wholly new appearance. Whilst growing they have grown into one another. Through employers' associations, buying arrangements, agreements as to prices and selling areas, a complex system of mutual attachments and dependencies has come into being. . . . This dovetailing of the individual-self into the community-self is what we are pre-eminently able to achieve. . . "

What Germany claims to have achieved in 20 years, the British Empire has accomplished in as many months. The conversion or aggregation of many thousands of industrial factories in all parts of the Empire into one huge arsenal for the manufacture of war material is, without question, the most remarkable example of the dovetailing, or sinking, of the individual-self into the community-self that could be imagined.

The absence of competition between engineering manufacturers since the outbreak of war has been mainly, if not entirely, due to the fact that the demand for war material has been more than sufficient to keep all of the old-established works, and many new ones, fully employed. It has, indeed, been an illustration of the fact that competition is entirely controlled by the law of supply and demand. It has been demonstrated by electric power supply undertakings that demand can be created to an almost unlimited extent. Therefore, to reduce or eliminate excessive competition, demand should be developed or increased to balance available sources of supply.

There are millions of British subjects working in overseas territories for the benefit of those who prefer to stay at home, who are just as appreciative of, and equally entitled to enoy, the comforts of modern civilization as those who are already benefiting by these conveniences. The scope for developing a demand for modern engineering appliances in this field alone is practically unlimited.

The need for more perfect co-ordination between individual producers and between producers and distributors is now freely admitted. There are, however, considerable differences of opinion as to whether the centre of such co-ordination or control should be the State, or some private enterprise such as an association of manufacturers, or, alternatively, some independent trading association.

The objection to private enterprise control is that any such undertaking must depend for its existence upon its profit-earning capacity, and where its aims in this direction conflict with the community interests—and there are bound to be many such cases—the latter will be liable to suffer.

On the other hand, the obections to State control are:—

1. Such control would be liable to stultify individual effort, and since the entire fabric of existing British trade supremacy is the outcome of the work of individual firms and persons, it should be the first essential of any scheme of industrial reorganization that individual effort be maintained in a state of maximum efficiency at all costs.

2. State control of any one trade or industry would entail the employment of a very large number of Government officials who would generally know much less about the subject than the principals of the firms they would be endeavoring to control. Moreover, it may be anticipated that the efficient co-ordination of the work of such numerous Government officials would prove to be a greater problem than that of co-ordinating the work of the firms to be controlled.

It appears that actual production, at least, should be left to individual effort, and should be entirely uncontrolled, though a closer co-operation between individual producers, such as is being effected by the various trade associations, and is the aim of the proposed trade parliaments, is undoubtedly to be desired. Some more direct control of distribution appears, however, to be necessary, but whether such control should be by the State or by private enterprise is still an open question. It is possible that some combination of State and private enterprise control may eventually prove to be the best solution.

The ideal to be aimed at is a subconscious co-ordination by indirect influence rather than the despotic mandatory con-

* From Paper Before I. E. E.

rol under defined rules and regulations usually inferred by reference to State control.

A symbolic illustration of such an ideal is afforded by the coupling in parallel of alternating-current generators where the sole controlling or co-ordinating influence is that resulting from the mere connection of the generators to common bus-bars. The generators may be of widely varying capacity, and of greatly differing speeds. They may derive their power, some from steam engines and boilers, or even from motors and secondary batteries. So long, however, as they are all connected to the common bus-bars, each to the several units will supply its quota of power to the demand upon such bus-bars.

To carry this analogy a little further, let it be assumed that the successful paralleling of alternators had hitherto never been achieved, and that every generator in this country was directly connected to a group of consumers whose maximum demand at any time was equivalent to the full-load capacity of the generator. Even though the efficiency of such individual units was the maximum attainable, it is obvious that the inability to take advantage of the improved plant factor, the increased diversity factor, and other economics accruing from parallel running and bulk supply, would result in a combined fuel consumption at least 100 per cent. greater than under existing conditions. Let it also be assumed that the individual unit supply service described is suddenly called upon to meet the competition of a bulk-supply undertaking able to run its generators in parallel. It will be evident that notwithstanding the established connections or goodwill of the individual supply units, the bulk-supply plant will be working under such advantageous conditions that it will rapidly capture all of the demand.

The above analogy represents the conditions under which many British manufacturers, with their individual producing units, were working prior to the war, in competition with the co-ordinated or parallel producing units of the United States and of Germany. The distributing networks of these foreign bulk-supply undertakings were being extended rapidly in every direction, but especially in British Overseas Dominions.

Those who favor State organization of distribution can point to an excellent example of successful indirect State co-ordination of industry in the Government Postal Service (service, not control). Here is no despotic dictatorship—no rules and regulations to control commerce, no interference with individual effort, and yet has there ever been a more potent influence upon the conduct of industry?

If some system of overseas trade service were inaugurated and run by the State, or by State and private enterprise combined, on the same general lines as the postal service, it should be a great boon to all industries. A service of this nature is by no means so impracticable as may at first sight appear.

It must, however, be essentially a public service, and not a trading concern, its first aim being to afford British subjects in all parts of the world facilities for procuring British-made engineering products on satisfactory terms, and its second aim to furnish British producers with the fullest possible information respecting overseas requirements.

Notwithstanding all that has been done in the past to maintain and improve British overseas trade, there is abundant evidence that the results achieved fall very short of possible attainment. For instance, a large amount of machinery and engineering appliances of all descriptions is imported into Canada every year, but it is estimated that less than 5 per cent. of these imports are manufactured in the United Kingdom.

The author's opinion is that maximum efficiency will only be attained by grouping the various elements, upon which successful overseas trade is dependent, under three self-contained, closely allied, and inter-connected sections which may be classified respectively as:—(a) Production, (b) co-ordination, (c) distribution; the suggested co-relation and constitution of these respective sections being shown below.

Production.

The sole aim of those responsible for production should be to manufacture appliances to meet the ascertained requirements of overseas markets (f.o.r. their own works) at minimum prices consistent with reasonable manufacturing profits and a liberal scale of wages to employes. In order that producers may be free to concentrate their entire efforts upon improving the efficiency of production, it should not be necessary for them to devote their attentions to the many intricate problems associated with overseas trade. At the same time, they should be entirely untrammelled by any unnecessary restrictions in the management of their respective businesses in which they, and they alone, are experts.

Co-ordination.

There are at the present time so many organizations devoting their attention to the problems of co-ordinating and reconstructing industry—particularly the engineering trades—that it is difficult to follow and keep in touch with the various projects which are being formulated.

Co-ordination may be defined as the most efficient utilization of all existing and potential factors of production and distribution. To ensure this, it is suggested that each of the several State and private enterprise organizations at present attacking the problems of overseas trade development from different aspects should be represented by one of its members on a central board of service, which board should be the recognized centre for all matters relating to overseas engineering trade. The primary obect of this board should be:—

(a) To provide for adequate representation of all British engineering manufacturers in every overseas market, for which purpose city shipping merchants having established overseas branches should be utilized where possible, and distributing centres under the direct control of the central board should be organized in those overseas territories where no existing channels for British trade exist.

(b) To ensure that every engineering manufacturer in this country shall have an equal opportunity of competing for overseas trade, for which purpose area boards of management—such as have been employed by the Ministry of Munitions for procuring the maximum and economic production of war material—might be utilized as a decentralized purchasing agency for the large variety of engineering requirements for overseas trade.

Very complete information respecting the productive capacity of engineering works throughout the country is already in the possession of the several "Munitions Area Boards of Management" created by the Ministry of Munitions for the purpose of procuring the maximum output of war material. This decentralized system of purchasing engineering products, which has proved to be such a satisfactory method of procuring munitions on an economic basis, should be even more beneficial for the purchase of the large variety of engineering requirements for overseas trade.

Distribution.

To provide for anything approaching efficient distribution of engineering appliances, it is necessary that in every overseas industrial centre a complete distributing organization shall be established consisting of a business general manager, an engineering staff, a number of sub-district salesmen (preferably local men well-known to every potential buyer in the particular department allotted to them), an accountancy and credit department, adequate clerical assistance, warehouse and showroom or exhibition accommodation, etc.

The managers of the respective distributing centres should

be men possessing tact, initiative, judgment and resource, as well as a wide field of general knowledge. They must be given absolute authority to enter into and execute all contracts without reference to headquarters, though they should report to the central board all transactions completed each week.

The engineering staff should consist of men who have been trained in engineering works in this country, and who are consequently familiar with British workshop practice and British standards. They would advise local buyers as to the type of British-made plant best suited to their individual requirements, and would carry out contracts for the erection of complete installations where required to do so.

The sub-district salesmen (or local travellers) would be allotted separate areas to work, of such a size as to enable them to keep in touch with all buyers of engineering appliances in their respective areas. Unlike manufacturers' salesmen, who are rightly expected under all circumstances to push the sale of their own principals' products only, distribution salesmen would be required to report to the local district office all prospects for engineering work of any description. Their sole aim would be to procure the maximum possible turnover in British-made apliances without favouring the products of any individual firm.

A good and trustworthy credit department is an absolutely essential adjunct to every overseas distributing centre. The usual terms of payment in, say, Canada, are 60 days after delivery at purchasers' works, or, alternatively, part payment on delivery and the balance in instalments, frequently extended over very long periods. The local banks invariably discount purchasers' promisory notes, and make collections through their various branches when due. The principal safeguard against bad debts is an efficient credit department. Every wholesale distributor submits all important orders before executing them, to his credit manager, who either knows or has means of ascertaining what is the financial position of every buyer, or prospective buyer, in the territory.

Any attempt to give or control credit from this side is bound to lead to heavy losses through bad debts, or, alternatively, to the loss of a large amount of profitable business.

The pricing and estimating department is possibly the most indispensable section of an overseas distributing centre. Numerous inquiries by mail and telephone, all calling for immediate attention, are received daily, and the conditions to be met are so varied that it is seldom an estimate prepared for one scheme can be used without modification for another inquiry. British manufacturers are frequently recommended to price their catalogues in the currency of the country in which they wish to do business. For engineering work this would usually be of very little, if any, value, since the cost of a plant f.o.b. English port is of no interest to the average overseas purchaser, who invariably requires the cost erected on site—say, 2,000 miles from the coast, and possibly some miles from the nearest railway siding—which cost will amount to from 150 per cent. to 300 per cent., or more, of the f.o.b. cost. Moreover, inquirers invariably call for composite tenders covering appliances made by a number of different firms. Thus a quotation for, say, a pump would usually not be considered unless it also included a petrol engine, suction-gas plant, electric motor, or other means of driving it, with switchgear, sundry pipe work, valves, tanks, etc. Performance specifications and detailed operating costs are also required with each tender.

As very few people in this country appear to have any idea of the cost of running an overseas distributing centre (manufacturers frequently suggest 5 per cent. as an adequate selling commission), the particulars of a year's costs, shown in Table I, actually incurred in one of the industrial centres of Canada, may be of general interest.

Table I.

Rent, rates, taxes, and insurances	£1,205
Salaries, management, engineering, and clerical	2,482
Salaries, salesmen, and travelling expenses	1,793
Packing and delivery charges	764
Office supplies, advertising, legal, and general expenses	572
Bank charges, interest, discount, and exchange	310
Postage, telephone, and telegrams	241
Depreciation and bad debts	396
	£7,763

Total turnover during period covered by above operating costs = £30,013.

Ratio of operating costs to turnover, 25.8 per cent.

Gross profit, £7,012 = 22.4 per cent. of turnover.

An analysis of the above charges appears to show that slightly more than half of the total expenditure is incurred on charges unaffected by turnover, but controlled mainly by the size of the area to be worked, whereas the remaining expenses are approximately proportional to the turnover.

The distributing area in which the results shown in Table I were obtained is known as the Middle West or Prairie Provinces of Canada. It is bounded on the east by the Great Lakes, and on the west by the Rocky Mountains, the chief centre of distribution being the city of Winnipeg. Some particulars of the developed portion of this area, given in Table II, will show how impossible it is to work such a district efficiently without incurring heavy operating expenses.

Table II.

Extreme length of district, E. and W.	Miles.	1,300
Extreme width of district, N. and S.	Miles.	300
Approximate area	Sq. Miles	160,000
Total mileage of railways	Miles.	10,000
Towns having a population of over 500		150
Aggregate population of above towns		770,000
Average population per town		5,000
Number of rural post offices		3,400

Finance.

In endeavouring to compute what capital or financial backing would be required to carry out the overseas engineering trade service proposed, one encounters the difficulty that the engineering industry covers anything from, say, the supply of the smallest electric motor to the equipment of a bulk-supply power scheme or the building of a railway. Whilst the organization, through its overseas distributing staff, would find many opportunities of rendering valuable assistance in connection with heavy engineering schemes, its principal source of revenue would probably be the profits on trading in general engineering merchandise of a kind that would be handled by shipping merchants.

Reference has been made to the desirability of procuring the collaboration of shipping merchants in all markets where such merchants have established distributing branches. The co-operative purchasing, and other features of the proposed central control scheme should greatly increase the previous profits and turnover of these established businesses—on the other hand, their experiences, local knowledge, and trade connection should be invaluable to the central organization. It is suggested that as an inducement to such firms to merge a portion of their increased profits in the co-operative scheme, they should be guaranteed an annual net profit equivalent to the average net profit during the three years prior to the war, and that they should retain in addition one-third of the extra profit earned each year as the result of the larger turnover, and other benefits accruing from their amalgamation with the central organization. The remaining two-thirds of the excess profits would be applied towards meeting the expenses of the central control board.

Commodity Prices and Public Utility Rates

Practically the only commodity universally used by the public of our towns and cities to-day which has not increased tremendously in price is electricity, and with it railway fares. Yet in the face of the universal advance in price, varying anywhere from 25 to 200 per cent., of the simple necessities which enter into the everyday life of the average citizen, the cost of electric current has, if anything, been reduced since the outbreak of war.

It is difficult to understand why this should be the case, and it is open to very grave question if the course we are pursuing in this respect is a wise one. The cost of everything that enters into the production of electricity is greater. Why then should not the product be more costly? The only explanation that can be advanced is that somewhere in the back of our heads we have a remote hope that as soon as the war is over the cost of manufacturing and delivering electricity will be quickly reduced. However, there seems to be very little ground for such a hope. Just as with other products, electricity depends upon the cost of materials and labor and a rapid reduction in either seems unlikely. The logical conclusion, therefore, would seem to be, in fairness not only to the operators, but also to the consumers, that the price of electric current rates and electric railway rates should be in proportion to the added cost of production. This is particularly true in view of the fact just stated, that any readjustment in prices to pre-war levels is more than likely to be a long-drawn-out affair.

An interesting address was delivered recently before the Wisconsin Gas and Electric Association at Milwaukee by W. J. Hagenah. Mr. Hagenah showed that historical precedents proved that the decline of prices from their present high levels will be very slow, even after the war is over. In consequence rate increases should be made now, not only for the duration of the war, but until such time as prices in general shall have become adjusted. An interesting chart was also shown, giving the movement of commodity prices over a hundred years of war and peace. At the present moment the upward trend in the curve is somewhat alarming and this may lead us to hope that the adjustment, to a certain extent at least, may be rather more rapid than in past history. The following extracts from Mr. Hagenah's address are very much to the point:

We are witnessing at the present time a most important development growing out of our disturbed economic and political conditions—one which is destined to have a most far-reaching effect on the operations of public utilities. Economists have for some time foreseen and predicted the condition which is now exerting such tremendous pressure on every form of activity, individual as well as corporate and public as well as private. There is hardly an individual or an enterprise that has not already felt this staggering force or is not destined to feel it in the near future, but among all forms of industry which are staggering to effect a readjustment none has suffered so acutely as have the public utilities. I refer to the steadily rising level of prices, to which such decided impetus has been given by our entry into the great European war.

For over fifteen years before the opening of the European war we witnessed in this country a gradually increasing price level. Coincident with this was our great industrial and commercial development.

The mine owner, the manufacturer, the farmer, the tradesman and the professional man met the rising level of prices by shifting the burden through increased charges for their product or his service, but not so with the utility. Its rates were fixed and could not be increased except by action of the proper public authority. So long, however, as the utility has not yet reached the reasonable limit of its technical development and while the territory which it served was still far from saturation, these increasing costs were largely offset by improvements in apparatus and methods. In fact, there are many instances where in spite of these conditions net earnings, because of especially favorable local conditions, showed annual increases. Electric production units were each year becoming larger and more efficient. The art of distribution and transmission was making great strides. The investment per unit of capacity generally tended downward. At the same time the demand for utility service was growing, and what fifteen years ago was considered a luxury in a short time became a necessity. As long as this condition was present the economies growing out of increased efficiency and service development tended to offset the rise in labor and material prices, but when relatively high efficiency had been realized and the increases in the price level appeared to be gaining in momentum, the trend of net earnings in most instances turned definitely downward. With the reasonable limit of expansion reached, the crisis in the history of the utility industry approached. Between the pressure of increasing costs and the declining purchasing power of the dollar of income net earnings were threatened with extinction. This, in brief, was the condition of the utility industry when in 1914 the storm of the European war burst on the world—a war which each year has enveloped additional peoples and has gained in fury and destructiveness. And with the coming of this war the level of prices, which was already at the highest point reached in a generation, turned abruptly and violently upward. which tendency it has maintained to this time.

Commodity Prices That Go Back a Hundred Years.

The diagram reproduced with this article shows Sauerbeck's ten-year average index prices for the years from 1817 to 1916, on which I have superimposed the annual index prices of the London **Statist** in order to show what has taken place beyond the period covered by the Sauerbeck data and what the extension of the Sauerbeck data for the next few years will reveal.

Just as the political history of the nineteenth century dates from the Congress of Vienna and the final defeat of Napoleon, so the economic history of that century also begins with the conditions then broadly recorded. The year 1815 is one of those years in history which marks an epoch and the influences of which time extend for many decades. In the next few years we are likely to witness another such epoch-making date, when the world, bled white by war, will close a chapter of great social and economic forces in conflict, in the soil of which mighty political movements will have taken root.

Let me call attention to the fact that from the high-price level following the Napoleonic wars to the high level of the Civil War period was approximately fifty years. Also, following the low point reached in about 1846, it was again fifty years before the low level after the civil war was reached. Singularly, it is now just fifty years since the high level of prices in the Civil War period. In view of these events of the last century, covering two complete major economic cycles, in each case growing out of conditions similar to those with which the world is confronted at this time, can it be expect-

ed that following the declaration of peace in this war we shall see a quick decline in prices to the pre-war level or lower?

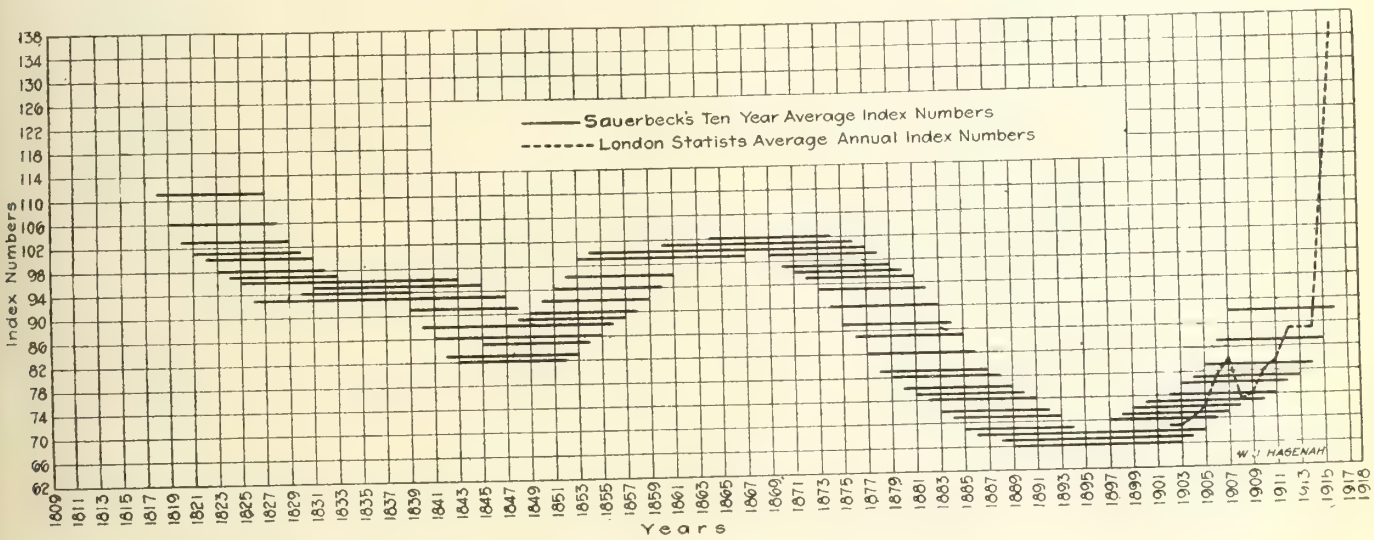
Prevailing Prosperity is Largely Fallacious.

In spite of prevailing conditions, we appear very prosperous at this time, but let us not be deceived. This is a war prosperity, and both England and Germany report the same kind of business activity. However, in view of what we know of conditions, it would be more correct to say that we are extremely busy rather than extremely prosperous, since we are not creating wealth. Our country, along with almost the entire world, is just now engaged under pressure of the greatest necessity in carrying on campaigns which are exhausting the man power and wealth of the world and from which all will emerge as peoples much poorer than before they entered. From this period of intense activity, of strained production and increasing consumption, we shall enter a period after the war when this destruction must be paid for by the hard labor and economics of the people. The reaction will be as great as was the action, but it will be extended over a much longer period of time. This does not mean that we shall at once have a serious depression. On the contrary, the necessity for urgent reconstruction and the accumulation of deferred work, will lead to considerable activity for a year or turn of peace, will lead to considerable activity for a year or more after the close of the war; but the period of readjustment and of producing from the soil and other natural resources and by hard labor the wealth to pay for these struggles will cover many years, and during this time we shall undoubtedly experience a relatively high level of prices, but with a gradually declining tendency the world over.

Based on the course of the price movement after periods of great world wars in the past and in view of the special conditions with respect to the currency and banking systems at the present time, we may look forward to a considerable period of high prices, a period of business readjustment and a period of new social legislation. What this means in its full significance to individuals, to business in general, and especially to public utilities, can be readily understood without attempt on my part either to generalize or to go into details.

However, reflect on what it will mean to business to be required to make extensions and to finance requirements on this level of prices while operating under a rate schedule determined five years ago if we should not return for fifteen or twenty years to the price level on which such rate schedule was based. What will it mean to business to have to purchase operating supplies on the price level of five years ago? The price level under which plants were built, under which franchise obligations were established and on which rate schedules were established may not again be reached in fifteen years or even longer. There are some who say that prices will decline quickly with the return of peace. Whether they will or not no one definitely knows, but when we stop to consider the extent and destructiveness of this world-wide war and remember the price movement after each of the other two great wars, it is not difficult to believe that many men in this room will not live to see the return to the price level of 1914.

As a result of this violent price movement which we are now witnessing the work of the utility commissions has not only been enormously increased but the character of their decisions reflects the really constructive purpose of such institutions. During the decade of commission activity extending from 1907 to 1917 the almost universal results of commission investigations were reductions in rates. For the larger part of this period the rise in prices was gradual but extremely moderate in comparison with the last two years; but these increases were in many instances offset by the increased efficiency in utility operations and the great extension in service. So elastic was the industry and so quick its response to reasonable rate reduction that these years, which represent an almost unbroken record of rate reductions, at the same time mark the golden years of utility growth—years during which public utilities reached a point of growth in size and stability comparing favorably with the greatest industries of history.



The movement of commodity prices in 100 years of war and peace.

At the present time, however, the commissions, which were quick to take advantage for the public of every economy in operation or profit resulting from improvements, are now foremost in granting relief from the pressure of high prices. Nearly five hundred public utilities have received increases in rates or have been relieved from burdensome obligations by state utility commissions and by city councils within the last fifteen months, and among this number are companies operating in many of the large centers of population. If the present tendency among state commissions and city councils to permit increases in rates to offset rising costs continues, the year 1918 will witness a practical cancellation of much of the work for rate reduction accomplished by these same authorities after many years of labor. It will also show that the original conception of a public utility commission as a continuing investigating body created to do justice to investor and public alike was correct, and that even in the midst of this great war, wherein every element of our national life is strained to the utmost, the desire for justice and fair play to all interests is still firmly grounded in the heart and mind of the public.

Electric Railways

Winnipeg Electric Railway Company Remodelling Their Entire Rolling Stock

The remodelling of the entire rolling stock of the Winnipeg Electric Railway Company, which has been under way for some time in accordance with an agreement entered into with the city in the latter part of April of this year is being proceeded with rapidly in the company shops at Fort Rouge. The entire work is under the supervision of T. L. Robinson, a young mechanical engineer of wide experience, and at the present time the remodelled cars are being turned out at the rate of six per month. While the remodelled cars are those that have been in the service for some time, the extent of the changes and modifications is such that when finished they present almost a new appearance.

The terms of the agreement state that the company in the remodelling of the rolling stock must make the cars modern in every respect. Front exits, improved lighting and route signs, removal of running boards and installation of folding steps are among the innovations called for. The folding steps manufactured by the McGuire-Cummings Co., of Chicago, have been adopted as a standard, and the lighting fixtures of the Safety Car Heating and Lighting Company will be used throughout.

The front exits will be on the same scale as the rear ones, only on a smaller plan. One 2-leaf folding door to fold out and back, to be controlled by the motorman, will be installed, with which will be operated a folding step provided with anti-slip tread and kick plate. In the right hand vestibule window an illuminated sign box of the Keystone type will be placed. A removable winter-proof partition for the motorman between the bulkhead exit and the vestibule door, glazed to allow motorman full view of exit door and step and provided with door for motorman, is a feature.

The interior lighting arrangements call for five shaded lights to be placed in the centre of monitor deck through selector switch on rear platform, sixth light to be on rear platform over conductor's position. Keystone illuminated side window signs will be installed in each rear window.

The rear bulkhead is to be installed with swinging door, on left side full panelling and sash in centre so arranged to care for sliding door to be installed on right hand side, swing door arranged to swing in and towards side of car. Sliding door at exit side to close toward body post. Centre double dash arranged to allow conductor to make announcements without opening doors.

The changes in the rear platform call for the installation of two 2-leaf folding doors in vestibule opening, rear set to fold out and back and front set to fold out and towards body. Rear half of vestibule opening is to be used for entrance and the folding step is to work in conjunction with the folding door. The first half of the vestibule opening is to be used for an exit and each door is to be separately controlled, the controlling handles to be mounted on rail near conductor. A protective compartment for the conductor is provided for with heater, raised floor and a seat.

A new fender type, similar to that in use, will be adopted, and the present trucks and motors will be removed. New or rebuilt ones will take their place. The new type of truck called for will be provided with 26-inch wheels with axles for G.E. 258 C motor or equivalent, and having 3¾ x 7 journals. The present brake quipment and rigging will be modified to work efficiently with the new truck and motor equipment. The bolster will be modified to allow the use of roller side bearings which will be installed. The remaining present electrical equipment will be modified to meet requirements of new motor equipment.

Twenty-five end entrance p.a.y.e. double truck trailer cars will be built. The cars will be 41 feet in length and have a seating capacity of 48. They will be patterned after the same style as the remodelled cars and will be equipped with two baby motors and straight air brake equipment with emergency feature. Folding doors and stops are called for and six shaded lights in the body and two in each vestibule will be installed. The route signs will be of the same pattern as the remodelled cars.

The open cars for summer use with the side running boards are also slated for treatment. The running boards will be eliminated and a centre aisle cut through. Only open cars are in use.

Greater Use of Electric Railways to Relieve Traffic Congestion

Following a campaign of publicity in connection with the value of motor trucks for relieving the traffic congestion at various large centres on this continent, the Electric Railway Journal has taken up the case for the electric railways, and maintains that these are not being used to their fullest capacity. Of course, in the United States the system of electric railways is much more complete and covers much wider areas than is true of Canada, but it is doubtful if the possiblities of our own electric railways for carrying freight have been sufficiently considered. It is easily believable that much relief could be given in a number of cities by the use of these lines, if not during the day-time at least from midnight till early morning when the passenger traffic is negligible.

It is true very few of the franchises of the Canadian street railway systems admit of carrying freight, but if it can be shown that the present congestion can be relieved in any way, there should be no difficulty whatever in having this restriction removed. In addition, it would probably add somewhat to the revenue of the street railway companies, which are so sadly depleted at the present time, owing to the fact that the cost of operation and maintenance is much greater than formerly, while the fare remains in almost every case the same.

There is no more anomalous condition existing to-day on this continent than the fact that the average street railway is still selling transportation at 5 cents a head or less, just as it was five, ten or fifteen years ago, when the price of everything else the man on the street buys has increased in value from 50 per cent. up. The result of course is that very few, if

any, of our electric railway systems are paying expenses, which means again that the tracks are being worn out and the rolling stock becoming dilapidated, to say nothing of necessary extension work being at a standstill. Unless something is done immediately to remedy this condition, it seems inevitable that many of the railway systems of Canada will be bankrupt and cease operations. All through the United States and in a few isolated cases in Canada, this situation has been realized and fares have been raised. For example, in Edmonton, a municipally operated system, the rate has just been raised to 7 cents for cash fares. Indeed the tendency appears to be to allow the municipally owned lines to make these increases, while at the same time, private companies operating under franchises are being held strictly to the franchise rate. However, there is no getting away from the unwritten law that the public gets exactly what it pays for, and if the rate at Vancouver, Montreal, Toronto and other cities, is held at 5 cents or less, just that much service will inevitably be supplied to the people who ride. When this condition becomes intolerable, the operation of the systems must cease.

In the article referred to above, a number of conclusions were drawn from the arguments presented. These are applicable to Canada, possibly, in less degree than in the United States, but nevertheless are of sufficient interest to quote:

Conclusions.

1. From a purely economic standpoint, existing electric railway facilities should be used to their fullest capacity before the development of any other type of freight transportation is attempted.

2. The investment in electric railway systems of the present day is so great that it would be most uneconomical practically to disregard a highly developed system of transportation service such as electric railways can render under present conditions.

3. Many interurbans are handling traffic which is commensurate with that of steam railroad service, and where facilities exist they are in a position to handle practically all short-haul traffic in their respective territories.

4. Federal asistance to the electric railways by supplying cars, improving physical alignment and freight terminal facilities would place the interurban railways in a position to handle a large percentage of the short-haul freight which is now congesting the steam railways.

5. Furthermore, the expenditure required to place the electric railways in the condition above mentioned, would not amount to one-tenth of that which would be needed for the extension of motor-truck freight haulage in the same territory now being agitated.

The article concludes as follows: Therefore, immediate relief can be secured for the steam railroads through assistance from an existing facility which only needs proper fostering to become immediately an important factor in our national emergency and for the future. In order to effect this, there should be universal interchange of freight rolling stock between steam and electric lines that can handle steam rolling stock, and federal financial aid to those electric lines that would be able to do so with the proper assistance.

For the year 1917 the gross earnings of the Calgary Power Co., Ltd., totalled $262,161 against $266,982 a year ago. Operating expenses at $40,059, however, compare with $49,923 a year ago, leaving net earnings at $221,202, against $217,058, in 1916. The net profit for the year after payment of interest charges was $71,212, against $65,209. From the year's surplus $35,000 was appropriated for depreciation, leaving the net balance in profit and loss account $143,947, against $107,735 in 1916.

Conductorettes in Kingston

The Kingston, Portsmouth & Cataraqui Electric Railway Company, Kingston, Ont., have been employing six women conductors for the last six months and three more have been trained to act as "spares." Mr. Hugh C. Nickle, general superintendent, advises that the "conductorettes" have been most satisfactory and that the travelling public are well pleased. The women are not required to operate



switches, this being done by the motormen. They do, however, operate the interlocking system where the street car line crosses a steam line. Our illustration shows the winter uniform worn. It is the intention of the company to provide a regular uniform which will likely be of tan color in order that dust will not show unduly. The male employees of the company have made no protest against the employment of women.

Motor Busses in Winnipeg

The Winnipeg Electric Railway Company is now operating four motor busses in a section of the city which is not served by the street railway lines in accordance with the agreement entered into with the city last spring that the street car service in outlying districts must be supplemented by motor busses until the trolley lines were projected in that area. The service is very satisfactory from the public standpoint and as there are only three busses in operation at one time, one is kept for emergency use should a breakdown occur.

The busses, which were illustrated in our issue of April

[illegible] the standard one-ton 16-passenger type, manufactured by the Studebaker Corporation, and embody all the details laid down in the detailed specifications provided for this style of car. The busses are finished in gun metal with an ivory stripe, weigh 3,700 pounds and cost $2,295 f.o.b. Walkerville.

The specifications of the busses are as follows: wheel base, 125 ins.; frame of pressed steel channel section 5 x 3 x 3/16 in.; width 36 ins.; length 186 ins. overall; transmission—selective type mounted on rear axle, 3 speeds forward and reverse; gear ratios—1st, 18.2:1; 2nd, 10:1; 3rd, 5:1; reverse, 23.7-8:1. Equipped with Timken roller bearings. Aluminum transmission case. Propeller shaft equipped at either end with universal joints, tubular 1⅝ in. 3/16 in. wall. Axles—front axle, forged L-beam section. Rear axle, full floating, equipped with Timken roller bearings. Cast steel axle housing. Axle shafts, 1⅜ in. in diameter. Chrome nickel steel. Radius rods. Drive is through radius rods. Torque arm—pressed steel channel section firmly bolted to transmission case and secured in axle housing by forged braces. Springs—semi-elleptic in front, semi-elleptic in rear. Spring centres—front, 37-11/16 in., 2 in. wide; rear 51 in., 2½ in. wide. Steering gear—left hand drive, 18 in. steering wheel, irreversible worm and gear. Spark and throttle control—Hand control on steering wheel, carburetor accelerator operated by foot. Wheels—wood, artillery type, 12 spokes. Heavily constructed for truck purposes. Brake drums securely bolted to spokes. All wheels equipped with Timken bearings. Tires—Dominion plain tread tires in front, 35 x 5 pneumatic. Safety tread tires in rear, 35 x 5 pneumatic. Clutch—cone type faced with woven wire asbestos material. Clutch pedal mechanism connected to ball thrust bearing on propeller shaft for shifting clutch. Pedal adjustable. Brakes—emergency, expanding band type; service, contracting band type. Brake bands faced with woven wire asbestos material 2 ins. wide, acting on 15-in. brake drum. Brake rods equipped with equalizer beams. Brake pedal adjustable. Hand control—centre control. Lamps—electric dash lamp, tail lamp and head lamps (the latter provided with dimmer switch).

Quebec Railway Fare Increases

The Quebec City Council has authorized the Quebec Railway, Light, Heat & Power Company to increase its street railway fares. The new rate is a straight 5c fare, (instead of 6 tickets for 25c), five tickets for 25c or 21 for a dollar. The workmen's tickets are to be 8 for 25c, and are good between 6 a.m. and 8 a.m. and 5 and 7 p.m. Children's fares are 3c each or 10 tickets for 25c. The question of extensions in the outlying wards came before the Council, but the Company pointed out that it was impossible to obtain the necessary rails, and as soon as those could be secured work would be commenced.

New Electric Traction Book

Electric Traction—By A. T. Dover, Lecturer on Electric Traction at the Battersea Polytechnic, London; Whittaker & Company, London and New York, publishers; price $6.00. This book is a treatise on the application of electric power to tramways and railways and is intended for engineers and advanced students. Representative examples of modern tramway and railway practice are included, but discussions on generating stations and transmission lines, as being a specialized subject, are omitted. The subject matter has been arranged as follows: Mechanics of train movement; motors; control; auxiliary apparatus; rolling stock; detailed study of train movement; track and overhead construction; distributing systems and sub-stations. A number of worked examples have been included in the text. The scope of the work may be gathered from the following chapter headings: Mechanics of Train Movement; Continuous-Current Traction Motors; Single-phase Traction Motors; Polyphase Traction Motors; The Testing of Traction Motors; The Control of Continuous-Current Railway Motors; The Control of Single-Phase Railway Motors; The Control of Three-Phase Railway Motors; The Control of Continuous-Current and Alternating-Current Motors for Regenerative Braking; Auxiliary Electrical Equipment for Tramcars; Auxiliary Electrical Equipment for Electric Locomotives and Motor-Coaches; Rolling Stock for Electric Tramways; Rolling Stock for Electric Railways (Motor-Coach Trains); Electric Locomotives; Train Resistance; The Calculation of Speed-Time Curves and Energy Consumption for Electric Trains; Tramway Track Construction; Track Construction for Conduit Tramways; The Tramway Track Considered as an Electrical Conductor; Conductor Rails and Track-Work for Electric Railways; Overhead Construction for Tramways; Overhead Construction on Railways; Feeding and Distributing Systems for Tramways and Railways; Sub-Station Converting Machinery and Switchgear for Continuous-Current Tramways and Railways. There are 518 illustrations and 5 folding plates; 667 pages. There is also a long list of 33 tables.

Mr. Kelsch is Vice-president

Mr. R. S. Kelsch, consulting engineer, of Montreal, has been elected vice-president of the American Institute of Electrical Engineers. The election was by letter ballot.

The American Institute of Electrical Engineers will hold their annual convention in Atlantic City, N.J., on June 26-27-28.



Mr. R. S. Kelsch.

C.E.A. Will Hold One-day Convention

The secretary of the Canadian Electrical Association has sent out notices that the 28th annual convention of the Association will be held at the Chateau Laurier, Ottawa, on Friday, June 21. The announcement states that as this is a war-time convention no entertainment will be provided and the matters discussed will be principally confined to the effect of the war on the central station industry. It is specially urged that there should be a full attendance of members.

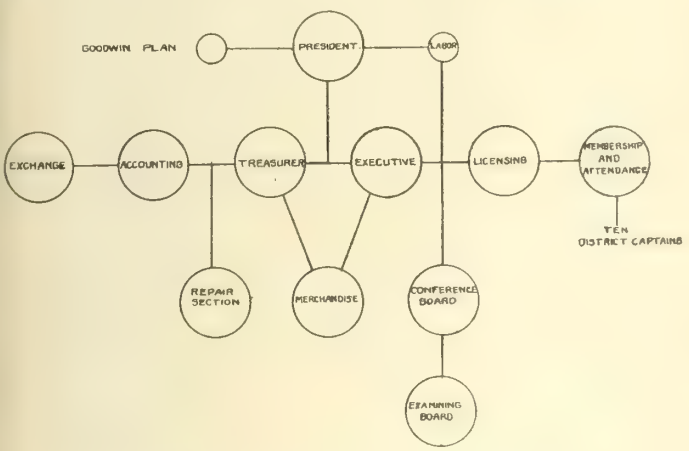
The Dealer and Contractor

Toronto Electrical Contractors Transact Much Business at Last Meeting of the Season

The last meeting and dinner of the season was held by the Toronto Electrical Contractors' Association in the Board of Trade dining room on Thursday evening, June 6. There was a good attendance and a very satisfactory representation of manufacturers and wholesalers.

President MacIntyre reported that he had sent out requests to the various manufacturers that they co-operate with the association in having their discount sheets made of such a size and punching as to fit into the association members' filing cases. A number of favorable replies had been received and in one case a proper size discount sheet had already been received.

The discussion centered chiefly around the form of organization of the association. The chairman outlined the plan that had been drawn up by the executive and which is reproduced herewith. From this it will be seen that the president confines his attention chiefly to the Goodwin plan of reorganization and to the labor committee, of which he is chairman. Along with him on the labor committee there is a



Organization plan of Toronto Electrical Contractors.

conference board of three members and an examining board of two members. The conference board includes Messrs. E. C. Clarke, G. E. Davenport, Kenneth A. MacIntyre, (chairman). Messrs. Harry Rohlader and Dan Robson comprise the examining committee.

Mr. Harry Hicks, vice-president of the association, is to have charge of the exchange sheet. This is a little publication which deals with materials, motors, etc., which the members of the association may buy and sell among themselves. Mr. Geo. Matthews, and one other member to be elected, were named on this committee. Mr. E. F. W. Salisbury, secretary of the association, becomes chairman of the accounting committee. Mr. Geo. T. Dale is chairman of the repair section and Messrs. J. Everard Myers, treasurer of the association, R. A. L. Gray and Geo. J. Beattie, (chairman), are on the merchandising committee, and will concern themselves with the issue of price sheets regarding materials, labor, etc. Mr. E. A. Drury becomes chairman of the licensing committee with members to be elected. Mr. Harry Rooks is chairman of the membership and attendance committee and under him will be ten captains, each having charge of a district, as already outlined.

A resolution was passed commending the work of the Compensation Board. During the year the rate has been reduced approximately 25 per cent. The secretary was instructed to write the Board expressing their appreciation of the manner in which the association members have been treated.

The Code of Ethics of the National Association was read and discussed and adopted unanimously by the members.

One of the most important items was the decision to take steps towards affiliation with the National Association of Electrical Contractors of the United States. The president was particularly insistent in this case that each member should be given an opportunity of expressing his views and there was no opposition.

The scale of fees, as worked out by the executive, will be according to the yearly business turnover and will likely be as follows: Up to $12,000, $20 a year; $12,000 to $25,000, $30 a year; $25,000 to $50,000, $40 a year; $50,000 to $100,000, $60 a year; $100,000 to $150,000, $90 a year; $150,000 to $200,000, $120 a year.

A number of members expressed their intention of going to Cleveland to attend the annual convention of the National Association, July 17—20, these being Messrs. Salisbury, MacIntyre, Clarke, Gray, Myers, Hicks, Drury, and Rooks.

A pleasing feature of the proceedings was the presentation of a substantial cheque to Mr. Geo. T. Cross, Mr. J. Everard Myers' assistant, who has given so freely of his time, energy and ability to the association during the past year.

133 Ranges Per Month

In the Electrical News of April 15 we described the successful campaign the City Light and Power Department of Winnipeg had put on to increase the sale and use of electric appliances. At that time Mr. R. A. Sara, sales manager, stated that they were inaugurating an electric range campaign and described its organization briefly in the article.

We are just in receipt of a further note from Mr. Sara stating that the electric range campaign resulted in the sale of 133 electric ranges in the city during April. He had anticipated that the May sales would be equally satisfactory but the strike then under way in Winnipeg would probably interfere.

A resolution extending the authority of the United States Secretary of War to grant permits for water-power diversion at Niagara Falls has been adopted by the Senate. An amendment to repeal the law prohibiting power companies from installing new machinery was defeated.

Electric Plants in Country and Farm Homes

The Farmers are Ready to Buy and Only Need to be Convinced— The Electrical Contractor is the Logical Salesman

The importance of farm lighting plants is again illustrated by the fact that Electrical Merchandising, in its May issue, has given over practically the whole of its space to a description of the various phases of this interesting subject—The value of the plant to the farmer; methods of convincing him that he needs it; what is the best type of man to sell it; the attitude of the farmer's wife on the question; the matter of profits; and so on. One of the most interesting articles is by Mr. L. C. Spake, who writes on the question of teaching men how to sell farm lighting plants. Mr. Spake says the farmer is going to buy lighting plants. Everybody in the electrical and inter-allied farm-lighting plant fields believes that. The open question is: **Who will sell him those plants?**

The chap who is distributing through the electrical trade says it will be the electrical dealer. The fellow with a bunch of specialty men as distributors says it will be a specialty man. Both answers may be all right for the immediate present, but in the near future, it seems pretty plain, the fellows who will get the farm-lighting plant business will be men who are combination dealers and specialty salesmen.

The manufacturers' sales-policy problem therefore simmers down to whether to hire specialty salesmen as distributors and try to educate them to be dealers as well, or to enlist the aid of established electrical dealers and try to train them or some of their men to become specialty salesmen.

There is absolutely no reason why both of the plans mentioned above will not work—with the net result that the electrical trade will be the gainer to the extent of acquiring several thousand better retail merchants.

The farm-lighting plant manufacturers who realize this—and most of them do—are getting busy on their program of dealer education. There is a particularly interesting development along this line in the group which is teaching dealers to sell farm-lighting plants. Take as an example, the activities of L. C. (Jack) Marron, whom all electrical dealers know as a fellow contractor and retailer. Mr. Marron has gone into the farm-lighting and power plant manufacture business. In addition to being an electrical dealer, he was formerly a Delco agent. He has sold plants of other makes as well as his own.

From the experience he gained in this work he has dug up facts and information to help show his own dealers how to sell. He contends that the fundamentals of the plan are applicable to any worth-while line of plants. What he has learned is of real value to the electrical man who contemplates hiring one man or a whole force of men to sell plants for him. When he was asked what he taught his dealers he replied:

"When we hire a man to sell plants to farmers we assume that that man at the beginning is 90 per cent. legs and 10 per cent head. We try hard to change the proportion by intensive education. When he arrives at a point where he appears to be 50-50 on legs and brains we give him a car to take him to places where his head can work—on the farmers. Up until that time he walks."

How "intensive education" means a lot more than those two words convey. Here is what a man has to learn.

Price and Terms His Opener.

The first time he approaches a prospect he is under absolute instructions to get the following information off his chest.

"My name is Bailey. I represent the Marron Manufacturing Company. I think I have the best farm-lighting plant that has been offered to the farmer. I believe I can prove it to you. This plant sells for $585 f.o.b. factory including battery. You build the foundation. We set up the plant and hook it up to your wiring and start it off for you. It is shipped bill of lading attached, a check for $25 accompanying the order."

The salesman as an opener has told his price and terms of sale! An unheard of process of selling, you will remark. And so did I. But here is the way Mr. Marron explains explains the logic of the plan:

"Suppose, for example," said he, "a salesman spends half an hour getting a farmer all worked up telling what a whale of a plant he has to offer. He talks about excellence of mechanical features, the guarantees, etc. During this time the farmer, who knows very little about what electrical machinery costs, begins to form an idea of what the selling price really is. His idea is usually about one-half too low—especially if the plant in question is a so-called high-priced plant. Then when the price is stated at the end of the conversation the farmer throws a fit, throws up his hands, and more than likely throws the agent off his place. In any event the agent has to start all over again.

Farmer Can See a $1,000-Value.

"On the other hand if the farmer has been told the price and terms at the outset the agent has prevented the prospect from making up his mind in advance to something which is not true. Then things can proceed on a sound business basis. There need be no fear in proposing a $1,000 proposition to a farmer. He is no piker. He has spent big money for machinery and equipment before and he can see a $1,000 proposition just as clearly as anyone if the seller has $1,000 worth of real value to offer."

When the prospective salesman has learned this much of his lesson he next tackles the mechanical features of the plant. He is given complete technical information on the engine, generator, switchboard and battery. For forty-eight hours he is supposed to devote real study to this literature. When he thinks he has mastered it he comes back for an examination. And it is some examination. "What is the piston made of? Describe the features of our ingenious oiling system. Tell how the laminated pole pieces of our generator are made." Those are some of the questions the salesman must answer to qualify.

Technical Detail Helps Explain Cost of Manufacture.

It may seem foolish to some to go into such intricate technical detail, but it is contended by farm-lighting manufacturers that the farmer is a "bug" for that sort of dope. He understands machinery in a general way and later in the sales talk when he wants to know why the plant costs so much, it is very effective to be able to point out the many minute and obviously costly operations that go, for instance, into the manufacture of a laminated pole piece. Moreover the farmer studies all farm-lighting plant sales literature and is better versed technically than might be imagined. So it pays to know and to talk some of the mechanical features.

The same idea applies to the battery. The agent is taught to state that the plant is sold preferably with a battery which

is positively guaranteed for five years. That always gets a rise out of the farmer who has had the sad experience of renewing his automobile battery at the end of one or two years, and most farmers have had that experience once or twice. The agent is even taught the details of construction of the battery so that he can actually convince the farmer that there is no "nigger in the woodpile" in that five-year guarantee.

Now all this sounds as if the plan was to "feed up" the farmer on nothing but "technical dope." But, not so. The agents are advised against talking technicalities more than twenty minutes. Then comes the "heart-interest stuff," so called. In reality it is not so much the sob-sister sort of story as it is just getting down to a sensible discussion of the farmer's home problem—in the farmer's own language. An average agent's talk runs like this:

Discussing the Farmer's Home Problems.

"Why, man, you ought to modernize your home like the city man. Even if you had a mortgage on the place that should make no difference. The salaried man in the city at $100 a month building a cottage out of Building & Loan funds would not think of doing without electric light. If you are not as progressive as he, how do you expect to compete with the city for the interest of your boys and girls? You want them to stay at home, don't you? But even at that it is really not a question of spending money. Buying a farm-lighting plant is really making an investment at 20 per cent. interest. As for the use you will get out of it, there is no comparison between it and your other equipment. You use your corn planter ten days each year, your binder seventeen days, your corn plow thirty days, your tractor fifty-six days and your automobile not more than 100 days a year. A farm-lighting and power plant is used 365 days a year."

The farmer usually recognizes the correctness of the average days' use of his equipment as quoted, but that "20 per cent investment" figure so casually thrown into the conversation loks questionable and interesting. To the farmer who is looking for a reason for not signing up, it looks like a chance to "trip up" this smooth agent. So he says "How do you figure that 20 per cent investment? How is a farm-lighting plant going to make me any money "

"The answer to that is easy," replies the agent, getting out his pencil. "'Now, your wife spends a weary half hour every day at the dirty work of cleaning lamps. That's three hours a week. She will admit (and I can see by looking at her clean house) that she spends two hours a week sweeping. Running the cream separator takes fifteen minutes a day or one and three-quarter hours a week. Some one has to spend fifteen minutes a day, or another one and three-quarters hours a week, pumping water and that is darned hard work. Churning takes an hour a week and the electric way produces more even churning than the hand process. Cracked feed goes farther than whole grain when fed to chickens and stock, and a light and power plant will save at least a half-hour a week from this job, in addition to reducing grain consumption."

In this way the agent runs through the farm duties in which there is a real opportunity to save time.

Reducing to Dollars and Cents the Savings Effected.

Then the agent continues: "I suppose you pay your hired man $50 a month and have to feed his horse. His total cost to you is around $75 a month. Say it is 35 cents an hour. (The farmer will admit this is conservative nowadays.) Your wife's time and your time is surely worth as much as that of your hired hands. And even if we go no further with the time-saving study than those items already mentioned we have a saving of ten hours a week or an annual saving of $182. In fact it would be easy to show how in time-saving alone the plant will nearly pay for itself in one or two years."

This sort of argument interests the farmer's wife who is usually "in on" the conversation. So does the "comfort" talk. The farmer is usually busiest in the heat of the summer, and it does not take much imagination to draw a picture of the solace of an electric fan on a hot summer evening. The pleasures of ironing on the porch instead of in the sweltering kitchen is another easy point to make. Plants have been sold on the argument that electric light relieves eyestrain and increases the ease with which children study. If any of the family wear glasses, this is a very strong point to emphasize in view of the supporting fact that city schools now examine the eyes of children and recommend glasses in many cases to increase their efficiency as students.

Closing the Sale Requires Tact and Persistence.

When things get along this far the farmer is usually not looking for a reason not to buy but he is certainly anxious to locate a reason for not signing the order to-day. The talk drifts to the cost of house wiring. A unit system figuring easily disposes of the wiring material and labor. Fixture selling has also been reduced to what is practically a Sears-Roebuck plan. On 100 loose leaves in a folder, different types and styles are shown and on the same sheet each fixture is fully described in glowing language.

Any one can read it to the prospect. It is written so that it sounds good—it sounds just as a real fixture merchant might say it. No real knowledge of fixtures on the part of the salesman is therefore necessary, according to the plan. A choice is made and the remainder of the loose leaves—except those showing one or two appliances, which the agents intend to figure in—are stowed away. The complete bill is figured and is quoted to the farmer in a lump sum.

In preference to quoting in the form of an itemized bill this method of quoting a lump sum is very strongly recommended. It leaves no room for haggling over details or for small eliminations from the order to effect a price reduction. When this price is quoted, added to the price of the plant, the sale is then down to the "closing point" where it seems that a large degree of persistence on the part of the agent is one of the largest determining factors.

The foregoing are some of the things Mr. Marron believes in teaching his agents. He also believes that the electrical contractors could well afford to hire salesmen and teach them these things. The smaller contractor-dealer is generally so busy himself that he has little real time to devote to farm-lighting plant sales. In consequence he is sometimes wont to put off starting his campaign "until next week when he has more time." Next week never comes. So the really progressive dealer hires salesmen and puts them to work on the job. As a piece of good advice on hiring these men Mr. Marron said, "Hire only the man who is willing to and able to finance himself for thirty days. If he cannot do that he is no success and the chances are he never will be." Experience shows that nearly all Mr. Marron's agents sold a plant within two weeks. Even those who did not finally make good succeeded in this. So the thirty-day financing need have no terrors to a man who is a real specialty salesman.

The real big message from Mr. Marron to his contractor-dealer friends, however, is: "Get into the game. Some one is going to make real money out of it. And that man will make most money who knows best how to teach men to sell farm-lighting plants."

Duncan Bond, Denver, Colorado, has joined the sales force of The Packard Electric Company, Warren, Ohio. Having been brought up in the west, Mr. Bond will look after the business of the Company in that section where he has won the enviable title of "Electrical Wizard of the West." He will be a strong addition to the Packard organization. It is said that the company is building some very large transformers for western interests.

Methods of Computing Overhead Expenses of Electrical Contractors*

Many articles that have appeared in the trade papers regarding overhead expense do not seem to cover the field fully and I do not pretend to be able to add anything to the volume of literature already published on the subject, but I promised to start the discussion, and believe if we each contribute some of our own experience we can apply the fruits of some of these articles to our local conditions.

No feature of our business is more important to the contractor or business getter than the subject of overhead expense. Most of us know too little about this at the beginning of the year and too much about it at the end of the year; and our present problem is to take the experience we get at the end of the year and use it at the beginning of the year, or when we are planning our business-getting campaign. No contractor should be satisfied with breaking even when managing an independent business. He should not be satisfied in making the same money that he would make if he were working for some one else on a salary. A contractor who does not make a profit above his salary would better close out his own business and take a position working for one of his competitors. In this way he will save gray hairs and worry, get more satisfaction and comfort out of life, be just as far ahead financially and have time and leisure to devote to the cultural things of life.

Overhead Expenses Same for All

We have it on no less authority than that of Mr. Goodwin, who made the statement in the Hotel Wisconsin at our January convention, that the larger contractor has a larger percentage of overhead than the smaller contractor. This I doubt very much. I do not believe there is any very great variation. I do believe, however, that overhead expense today is very much greater than it was a few years ago. Overhead expense should cover all such items as rent, telephone, manager's salary, insurance, postage, printing, automobile maintenance, office salaries, advertising, superintendents' salaries, interest, legal expenses, and the proper allowance for bad accounts and for breakage or loss of material. The small contractor may think that he saves some of these items, but if he analyses matters carefully he will find that he has to pay them all in the end. If he is his own manager, he should consider the salary he would be making if doing it for someone else and should charge himself with the same salary. When all these things are taken into consideration I believe he will find his expense running between 20 per cent. and 25 per cent. of the sales. In discussing these problems it is customary to assume a figure of 25 per cent. This may have been right a few years ago, but we believe it should be more now.

Three Methods of Getting Overhead

First Method.—It is a very simple matter for us at the end of the year to sit down and take our expense after the bills are all paid, figure out a percentage of overhead and determine to use it through the following year, but I believe a more careful study of the matter is needed than by simply arriving at a certain percentage. I have not seen any article suggesting any method of figuring overhead expense except to take a flat rate and apply it to all our business. This we will call the first method.

But this I object to. If we take this percentage and apply it to the sale of an attachment plug where we fiddle around 15 or 20 minutes making a connection for nothing, you are going to be very sadly in the hole. If we take this percentage and apply it to a 15-horse-power motor you are going to be beat out by some of your competitors. I do not say that it costs as much time or worry to connect the 25-cent attachment plug as it does to sell the $250 motor, but I do say that the percentage of overhead should be as many times as great on one job as on the other.

Second Method.—The second method advanced for solving this problem is to have a different rate of overhead to apply to different pieces of cost. This can be illustrated by a chart covering the year's business. Now this chart gives a complicated method of figuring expenses wherein you will have to use some such proportion of this:

Material	$100.00
5 per cent. overhead on material	5.00
Labor	50.00
14 per cent. overhead on labor	7.00
	$162.00
25 per cent. on general expense	32.40
	$194.40
10 per cent. profit (approximately)	20.60
Total	$215.00

This is the second method of figuring overhead expense and one that is used in most businesses, but to which I still object as it does not show the proper relation of cost between small and large jobs.

Third Method.—What I am trying to get at is that it costs a great deal more in proportion to handle the small job than it does to handle a large job. If we have a hundred $5 jobs and one $500 job, we will figure 9/10 of our time fiddling around with the little job and 1/10 attending to the large job. I believe that the little jobs should carry many times the overhead expense that the big job carries. I do not know any way to separate this expense between the small and the large jobs in the way I have done between material and labor above.

But the truth is we are getting a higher rate of gross profits on the small job and we believe this will give us a key in the right proportion in figuring this expense. I have, accordingly, analyzed the business of a certain month and grouped together all the jobs that cost less than $1, $2, etc. You will find the same standard in all these groups, namely, that we are taking a much larger gross profit on the small job and a much smaller gross profit on the large jobs. I got still better results by taking together the entire group of jobs handled in four months, as shown in the table herewith:

No. of Jobs	Sale	Cost	Average Cost	Per cent. Gross Profit
382	$ 409.34	$ 205.69	$ 0.54	99
380	1,236.31	649.30	1.71	90.3
201	1,632.65	907.37	4.51	79.
192	3,802,53	2,325.15	12.11	63
125	5,850.82	3,905.77	31.24	50
90	7,974.21	6,322.41	70.25	26.1
51	8,194.06	6,678.58	130.95	22.6
14	4,992.47	3,942.90	281.58	26.6
13	16,816.90	13,403.45	1,031.03	25.5
1,448	$50,909.29	$38,339.81		

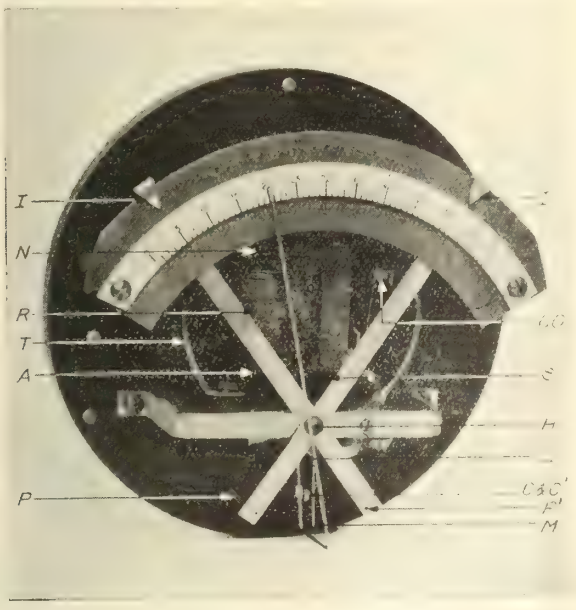
This gives a total of 1,448 jobs at a total cost of about $38,000, and a total selling price of nearly $51,000. I argue that it is fair to apply our overhead expense in the same proportion as the gross profits on this group of work. If we can get some way to figure overhead expense so it follows a definite line, we will get a method which will let us put a fair price on all our work.

* By P. C. Burrell, before Wisconsin Contractors' Association.

What is New in Electrical Equipment

A New Pressure Governor for Gas and Liquid Systems.

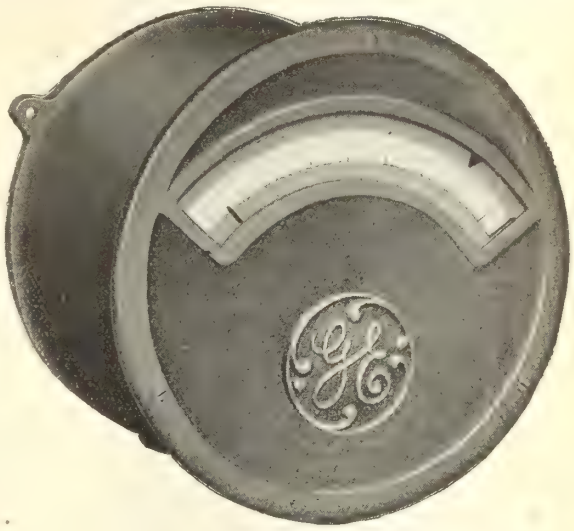
A new pressure governor to control standard self-starters for motor operated pumps and compressors has been developed by the Canadian General Electric Company. The governor maintains a pressure between predetermined limits on any gas or liquid systems that will not corrode the Bourdon tube. This governor is called the CR 2922 and can be used on any standard A. C. or D. C. circuit. It is rated for pressures of 60, 100, 160, 300 or 500 pounds, and operates within settings of from 3 to 12 pounds between high and low pressures. Governors for higher pressures can be supplied if desired. The governor consists of a Bourdon tube, an indicating needle, a graduated pressure scale, adjustable high and low pressure stops to detemine the desired pressure range and a relay which actuates the contacts in the control circuit of the self-starter, all enclosed within a dust-proof case easily opened for inspection. Action of the governor is dependent on the Bourdon tube which should be connected to an independent discharge pipe from the pressure tank. The free end of the tube "T" (See Figure) is mechanically connected to the indicator needle "'N," moving it over the scale as changes of pressure affect the tube. After the settings for the pressure



Pressure governor, cover removed.

range have been made, the governor will automatically maintain pressure within those limits.

The operation of the pressure governor is as follows: Assuming that the pressure is at the low value, as indicated by the left hand indicator (I), the contact (C) on the needle (N) completes the circuit through the contact (C') on the movable arm (M) which at the low pressure point rests against the stop (P'). When this contact is made, the circuit is completed through the relay coil (R), causing the armature (A) to close. Attached to this is the contact (CO) which upon closing, completes the control circuit to the self-starter, causing the motor to start. The armature is also attached to the spring (S) which holds the contact (C') firmly against (C) until contact is broken at (P). As the pressure increases, the needle pointer moves to the right, but its lower part to which the contact (C) is attached moves to the left, and is followed by the movable arm (M). When the high pressure point is reached, the movable arm is prevented from traveling farther by stop (P) and the needle continues its course, breaking the circuit by separating contacts (C and C'). The instant the circuit is broken, the delay (R) is de-energized, its armature falls, releasing the tension on the spring (S) and because the movable arm (M) is counterweighted it returns to the stop post (P'). When the pressure is decreased to the minimum value, the contact (C) again completes



Pressure governor, complete.

the relay coil circuit by engaging contact (C') and the cycle of operation is repeated. The case is tapped and drilled at the bottom for the pressure pipe and electrical conduit connections.

Instrument gives Warning of Peak Load Excess

The peak load and its effect on the distribution system, has perhaps been given more consideration by station engineers than any other problem with which the latter have had to deal, with the result that its effect on the commercial success of the undertaking is very fully realized. The result has been the adoption of a number of different methods of charging, each suited more or less to specific local conditions. Among these methods may be mentioned:

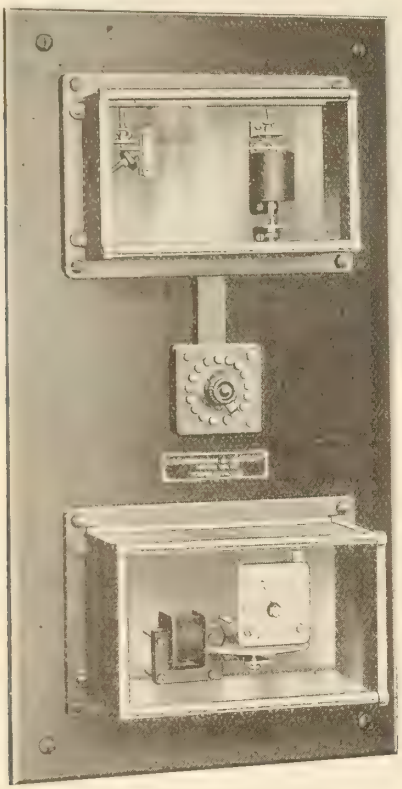
1. Ampere maximum demand;
2. A two rate principle;
3. A restricted hour use;
4. Flat charge for a definite h.p. with a motor reading in kilowatt hours all current consumed in excess of the definite h.p.;
5. Kilowatt hours maximum demand;
   - (a) Based on the h.p. installed;
   - (b) Based on the maximum demand meter;
   - (c) Based on the graphic meter.

Of these 5 (b) and 5 (c) are becoming more and more common for large customers and would appear to be essentially fair to both the customer and the supply authority, provided that it is understood by the customer. Unfortunately this is not always the case, and the effect on the customer is easily illustrated by an actual example. Presume that the normal requirements of the customer caller for 100 h.p. In one particular district of Canada the service charge as shown by a maximum demand meter is $1.00 per h.p. per month.

The meter charges is: The first 50 hours use at 2.6; the second 50 hours use at 1.8, the balance at 1.5. Assuming that the customer runs 10 hours per day on the unrestricted basis, the bill is subject to discount of 10 per cent. cash, and would read as follows:

Service charge	100 H. P.=	$100.00
Consumption charge		
First 50 hours' (75 kw. x 50)=3750 kw.h. at 2.6		$97.50
Second 50 hours'	=3750 kw.h. at 1.8	$67.50
Balance, 150 hours	=8250 kw.h. at .15	$12.40
Total	15750	$277.40
Cash discount		$27.74
Net Bill		$249.66

For a load of less than 200 h.p. the peak is taken at one minute. Therefore if once during a month, due to carelessness



Instrument for giving peak load warning.

or ignorance, the load is permitted to rise to 125 h. p. for one minute, the bill would read as follows:

Service Charge. 125 H.P.		$125.00
Consumption Charge.		
First 50 hours (93.7 kw. x 50)=4680 kw.h. at 2.6		$122.00
Second 50 hours use	=4680 kw.h. at 1.8	84.50
Balance 6390 kw.hrs.	at .15	9.58
Total	15750	$341.08
Less 10 per cent. discount		34.10
Net Bill		$306.98

This shows that the customer would pay $57.32 more in the second instance than he would in the first for exactly the same kw. hours consumption, in spite of the fact that the output in his factory would probably not be increased at all.

To assist the customer to control this situation, an instrument has recently been placed on the market which gives the customer warning when the peak duration is prolonged. This instrument is shown in the Figure. It consists of a current element, rheostat for control of the current element, time lagging element, bell ringing transformer and bell. The current element is built with a standard of 5 ampere winding for use with the transformer. It is capable of adjustment to the required lead by means of the steps of the rheostat, from 1.5 to 5 amps.

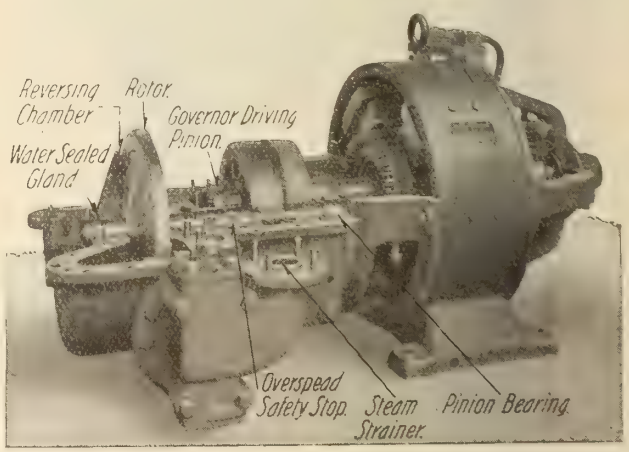
The time element has a range in the instrument shown, from 0 to 5 minutes. The time range can, however, be arranged for any particular requirements by a slight change in the gearing. The method of operation is as follows:

The current element is set to the maximum load required during the month and the time element slightly under the maximum permitted by the power contract for the above amount of power. When the current rises to or above the set maximum, the current element immediately operates, throwing current on to the time element. This element then operates until the time setting is reached, when the bell rings out a warning that the load is excessive. The construction of the instrument is such that it is only necessary to reduce the current 3 per cent. below the predetermined load for the bell to cease ringing and reset the time element.

Platinum points are used throughout, and the meter, if anything, errs on the side of solid construction. The instrument is being manufactured by the Chamberlain & Hookham Meter Co. Ltd. of Toronto, following the design of Mr. S. L. B. Lines, the general manager of the company.

Small Geared Turbines.

To drive small electric lighting outfits, exciter units for large alternators, or for direct mechanical drive, there has been a demand for a line of steam turbines which would be constructed along the same lines which give durability, ease of adustment, and high economy to the larger turbine units. To meet this demand, which now comes principally from our new merchant marine for lighting sets, the Westinghouse Electric & Manufacturing Company has developed a line which is being manufactured in sizes from 15 to 50 kw. for direct-current service; from 30 to 50 kw. for alternating-current service, and from 30 to 100 h.p. for mechanical drive. This machine is a geared unit, very compact, and of rugged



construction, as shown in the view of the direct-current unit. The turbine operates at a speed of 7200 r.p.m. and it is suitable for both condensing and non-condensing operation. It is built for normal operation on any steam pressure from 75 lbs. to 250 lbs., and for non-condensing operation on any back pressure up to 20 lbs. It embodies the three-point suspension principle, being supported by two lugs on the generator and one under the centre of the turbine, thus maintaining perfect alignment of the turbine, gear and generator.

The generator is of the well-known Westinghouse "SK" type, compound wound, with commutating poles. This designe insures sparkless commutation even at heavy overloads without shifting the brushes—an important advantage since no

attention is required to adjust for changing loads. Coils are impregnated by the vacuum process, making them proof against even extreme dampness. The outboard generator bearing is supported by a single-piece bracket bolted to the frame. In this a steel shell lined with babbitt forms the bearing itself; it is pressed and pinned into place and in case of trouble can readily be renewed by driving out with heavy hammer. Oiling is by a ring running over the shaft and dipping into an oil well. The shaft may be pressed out of the armature without disturbing the connection between coils and commutator. Liberal spaces for ventilation are provided. The internal construction of the turbine is practically identical with that of the larger machines. It consists of a single rotating wheel with blades or buckets around its periphery; the steam from the directing vanes or nozzles impinging against these blades, causes the wheel to rotate and the work to be performed. The full energy of the steam is extracted by using only one wheel with the aid of what is commonly known as the re-entry principle; that is, the steam after passing through the blades the first time, is changed in direction by means of reversing chamber and is directed against the blades a second time. The nozzle and reversing chamber are made of phosphor bronze, designed specially to resist the erosive action of steam at high velocities. In the 15 and 25 kilowatt units, the nozzle block contains but one nozzle, while in units from twenty-five to fifty kilowatts capacity, the block contains two nozzles, one of which is controlled by a hand operated valve; at partial loads this valve may be closed and thus the water rates are greatly decreased, and a much higher efficiency is obtained.

One of the special features on this unit is the automatic throttle valve, operated directly from the governor by means of a connecting rod. This valve is of the balanced type and very sensitive in operation, thus insuring a close speed regulation. One of the latest refinements provided on very few small turbines, is the overspeed governor release. This is a simple device contained in a small hole drilled in the shaft between pinion and rotor, and it consists of a cylindrical weight held in place by a coil spring surrounding it. In case the turbine should speed up to ten per cent. above normal speed, the weight due to centrifugal force, overcomes the spring tension and protrudes a short distance from its normal position. By so doing it comes in contact with a lug, which, in turn, is fastened to a lever, the movement of which trips the throttle valve catch and allows the valve to be closed by a heavy coil spring.

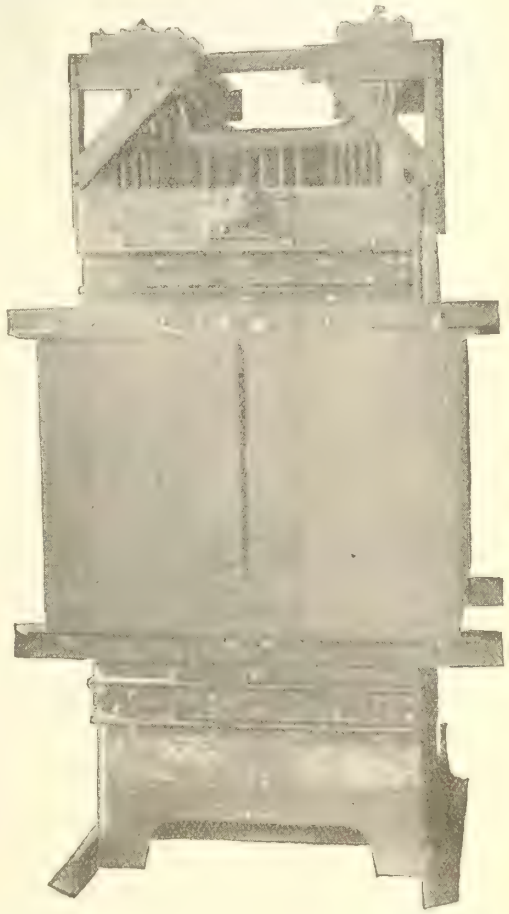
Large Hydro Transformers

The Canadian General Electric Company is now completing, at Peterboro, an order for fifteen 5,000 kv.a., 25 cycle, 110,000 volt transformers for the Hydro Electric Power Commission of Ontario. These transformers are for the Strachan Avenue Terminal Station of the Commission at Toronto, and nine of the fifteen units are already installed. When the installation is completed in a month or two, the Commission will have in this station a total transformer capacity of 75,000 kv.a., on the basis of 40 degs. C. rating or approximately 100,000 kv.a. on the basis of maximum rating.

The Toronto Station was originally laid out for two banks of 1,250 kv.a. transformers with one spare unit. At a later date, the 1,250 kv.a. units were replaced by 2,500 kv.a. units, and later, the station was extended to accommodate three additional banks of 2,500 kv.a. transformers. Two of these banks were installed but, before the last bank was ordererd, the decision was reached to again double the unit capacity. To accomplish this with the floor space limitations of the original transformer pockets, it was necessary to increase the height dimensions very materially. The new units measure 24 feet from the rails to the top of the high tension heads. This accounts for the slim appearance of the tank as shown in the accompanying cut. The floor space limitations also precluded the possibility of using core type construction in this case.

The transformers are shell type units with reinforced steel plate housing and supports. The economy in weight by this construction made it possible to utilize the existing foundations without material change, in spite of the fact that the main weight of the transformer loading is carried over to the central foundation wall by a short cantilever construction.

The transformers have button type spacers between coils and the coil ends extending above and below the core are firmly braced against distortion from short circuit strains.



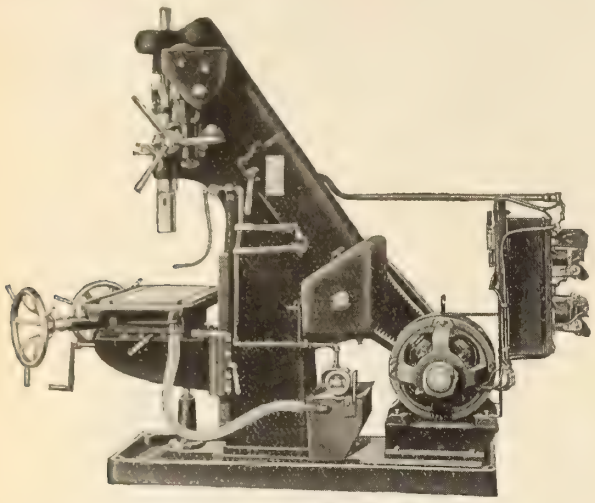
Particular attention is drawn to the appearance of the core in the accompanying cut showing the core and the coil housing. The cut, however, does not do justice to the unusually fine results which the Peterborough organization is accomplishing in piling sheet steel laminations.

The tanks for these transformers, which, it will be noted, are without horizontal seams, were made at the Davenport Works, Canadian Allis-Chalmers, Limited.

Motor-Driven Drill and Tapper

To speed up production without danger to machine or operators, is the purpose of the new Barnes self-oiling, all geared drill and tapper which handles high speed twist drills from ½-inch to 2 inches. This is essentially a manufacturing machine, built for heavy duty work and rapid production. Belts are entirely eliminated, all power being transmitted through gears. With the exception of the spindle sleeves and cross spindles, all bearings and all gears are continuously lubricated by an automatic self-oiling system. The oil for this purpose is pumped from the reservoir at the base of the machine by a geared pump. Eight changes of speed are provided, with control levers within easy reach of the oper-

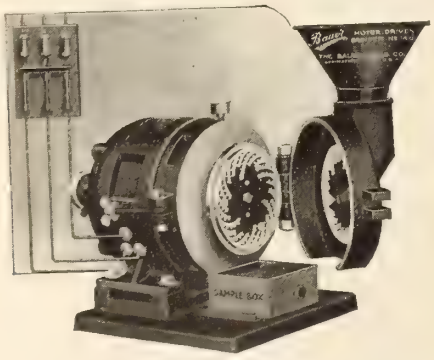
ator from his position in front of the drill. The spindle may be stopped by placing the shifter lever on the neutral position, or by throwing out the clutch gear. All transmission gears except the friction clutch gears, are cut from special high-grade chrome nickel steel, heat-treated, and tempered to



prevent wear, and to increase strength and stiffness. There are ten instant changes of geared feeds, controlled by levers directly in front of the operator. The feeds are indicated in plain figures on an index dial plate. All important feed gears are cut from steel and are case-hardened. A safety collar protects the machine against damage from overloads. For tapping, the machine may be equipped with an automatic reversing mechanism, which is very desirable, especially for depth tapping. A trip on this mechanism can be set so that the instant the tap reaches the depth required, the spindle will automatically reverse. It is also possible to set the shifting lever so that when tripped, either automatically or by hand, it will return to the neutral position, thus stopping the spindle instantly instead of reversing it. A small hand trip lever is always ready for use if it is desired to stop or reverse the spindle at any point in the operation. These machines are driven through a silent chain by a Westinghouse 10 h.p. direct-current motor provided with a Westinghouse automatic starting panel. This panel is shown exposed in the illustration, but is provided with a metal case when desired. All gears are entirely enclosed, meeting the requirements of modern safety laws.

Electric-Driven Laboratory Grinder.

A unique electric-driven grinder for laboratory service has recently been developed by The Bauer Bros. Co., Springfield.

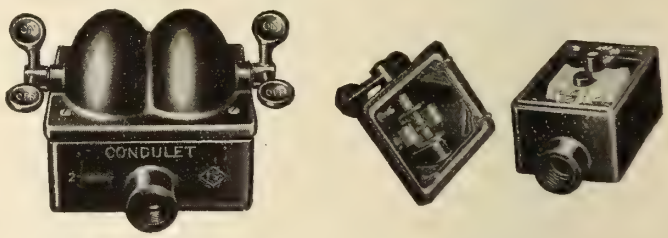


As shown by the illustration the outfit consists of a Robbins & Myers motor with one end head replaced by the grinder mechanism which is directly connected to the motor shaft. The grinder opens like a watch and all interior parts are readily accessible and easily cleaned, so a variety of materials can be ground in the machine without any one sample being contaminated by the others. The outfit is used chiefly by commercial laboratories for grinding samples of cotton seed cake, linseed cake, corn cake and feed stuffs of all kinds, also for coal and nearly any materials which require grinding in the laboratory for analysis. The outfit is also used where small amounts of materials are ground continuously and for this service it is provided with a special base which permits a constant flow of materials to pass through the mill. The dimensions of the outfit are as follows: Height overall, 24 inches, width overall, 16 inches; length overall closed 25 inches, open 32 inches. The hopper is 10 inches in diameter, and the plates are 8 inches in diameter. The speed is 1800 r. p. m. and the weight is 300 pounds.

The outfits are regularly stocked with 3 horse-power, 220 volt, 3 phase 60 cycle motors, but can be furnished on order with 2 or 3 phase, 110, 440, or 550 volt motors.

Makes Push Switch Installations Steam-Tight

Double push button switches, because of their ease of operation, have always been popular, but their use has been restricted by reason of the liability of moisture, gas or dust getting into the operating parts. The Crouse-Hinds Company have designed and placed upon the market a cover with a switch-operating mechanism for use with these switches, when installed on condulets of either the FS or FD series, which eliminates the objectionable features. This cover is made in one and two-gang forms. In one of the accompanying illustrations a two-gang cover is shown installed on a condulet, while the other illustration is of single gang condulet and cover, with cover unmounted. Like the condulet, the cover is a casting, either iron or brass, as specified. Iron covers are regularly finished in black enamel, although



galvanized finish or any other plated finish will be furnished, if desired. Marine finish is standard for brass covers. The mechanism which operates the push button is under the dome of the cover and is controlled by a shaft, flattened at its inner end and extending through the side of the cover, where it terminates in the operating handle. That portion of the shaft which passes through the cover is provided with grooves containing hard grease, which effectually seals the bearing, and a rubber gasket likewise seals the joint between the cover and condulet. "On" and "Off" indicators, cast on the ends of the handle, facilitate the operation of the switch. With this cover and the necessary condulet, it is now practical to use push switches in places where excessive moisture, explosive or corrosive vapors or fine dust circulate in the atmosphere, as in marine use, ammunition plants, refineries, textile and flour mills and the numberless other locations which readily suggest themselves to the electrician. Complete description and listings of these covers are given in Condulet Bulletin No. 1000H, which has just been released by the Crouse-Hinds Company, and will be mailed on request.

Mr. Henry Holgate, consulting engineer, Montreal; Mr. Guy W. Currier, chief counsel for the receiver of the Bay State Street Railway Company, Boston; and Prof. Albert S. Richey, Worcester Polytechnic Institute, Worcester, Mass., have been appointed by the New Brunswick Government to investigate the affairs of the New Brunswick Power Company and decide upon the merits of that company's application for an increase in rates in street car fares in St. John.

Personals

Mr. S. Wilkins, formerly engineer, Winnipeg Electric Railway, has been appointed maintenance engineer.

Mr. C. Bibby has been appointed assistant superintendent and secretary of the Sudbury-Copper Cliff Suburban Electric Railway, succeeding the former secretary, Mr. M. J. Powell.

Mr. Lawford Grant, manager of Eugene F. Phillips' Electrical Works, Ltd., has been elected a representative of the Montreal branch of the Canadian Manufacturers' Association on the executive council of the Association.

Captain W. G. Conway has been appointed secretary of the British Columbia Association of Electrical Contractors and Dealers. Captain Conway is said to be one of the livest wires in the city of Vancouver and there is every indication that this Association will forge ahead.

Major George W. Shearer, M. Sc., Assoc. Mem. of the Engineering Institute of Canada, Montreal, has been awarded the D.S.O. Before joining the 27th Battery, C.F.A., in 1915, he was practising as an electrical engineer, being a graduate of McGill University. He is in command of the 11th Battery, C.F.A.

Mr. F. H. Williams has been appointed publicity agent of the Winnipeg Electric Railway Company, succeeding Mr. H. C. Howard. Mr. Williams will continue the policy of this company of cementing the bond of good fellowship between the Company and its patrons in all matters pertaining to the operation of the system.

Mr. Thomas Henry has opened an office at 58 Front Street West, Toronto, where he will act as consulting engineer on power proposals, including both construction and operation. Mr. Henry is also acting as machinery broker for power equipment of all kinds—steam, electric and hydraulic. He has had wide experience, having designed and built the Erindale hydro-electric plant of the Interurban Electric Company and, as chief engineer, operated this plant for 12 years. He has latterly been on the staff of the Toronto Electric Light Company.

Trade Publications.

Ward Leonard—Enamelled Resistance Units, another booklet on field Rheostats, by the Ward Leonard Electric Company; both well illustrated and containing a quantity of useful, general information.

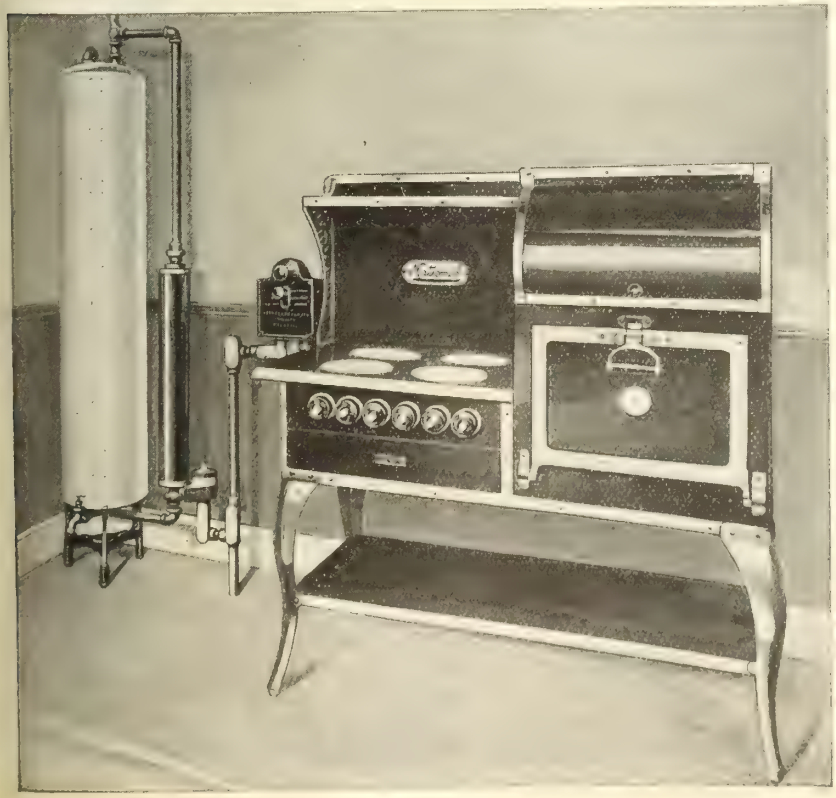
Induction Motors—Bulletin No. 3000 by the Canadian General Electric Company; illustrating and describing polyphase induction motors.

Electrical Features in New Ship Industry

Coincident with the establishment of the wooden shipbuilding industry in the West were born many dependent enterprises—among these the turning of wooden spars, which is handled by such firms as the Western Spar Company, of Portland, Ore. In former days this work was done mostly by hand labor, or steam-driven machinery, but to-day the entire equipment is electrical. In the above company's plant there are two large woodworking lathes, which can turn spars 160 feet in length; they are equipped with 220-volt, 3-phase induction motors, as follows: Three 15 h.p. three 5 h.p., three 1 h.p., and one 3 h.p. The 15 h.p. motors are on the carriages to drive the cutting tool and other apparatus, and have to be installed with long, flexible cable connection, so that they may be run back and forth over the 160-foot length of track. Plugs are installed midway on the run and supporting the cable on strain insulators strung on a steel messenger wire.

Electric Railway Supplies—Catalogue No. 18, by the Drew Electric Company, Indianapolis; illustrating and describing their line material and electric railway supplies—a handsome catalogue of 96 pages.

The Quebec Streams Commission have returned all tenders for the construction of the proposed storage dam at Lake Brule, ten miles from Beaupre, P.Q. The estimates were too high to justify, in the opinion of the Commission, work being proceeded with, and it has consequently been postponed. The dam would have given additional water power to the hydro-electric plant of the Laurentian Power Co.



A Handsome Catalogue of Electric Heating Equipment.

The National Electric Heating Company, Toronto, are distributing a handsome 56 page catalogue describing their various products. These include domestic and commercial irons; a variety of household and kitchen utensils, such as toasters, disc stoves, percolaters, chafing dishes, etc.; their well-known line of electric ranges from a single burner hot plate to the biggest range required for large families, hotels or restaurants; circulation water heaters; glower type air heaters; portable and stationary air heaters for the home, office, warehouse, street car or automobile; luminous type house radiators; special radiators up to 200 kw. capacity; a number of special appliances such as glue pots, celluloid press, bread sealing machine, electrically heated glove forms, etc. The catalogue is splendidly illustrated. The illustration herewith shows a model arrangement with range and hot water heater occupying a minimum of space and giving a maximum of service.

Current News and Notes

Brantford, Ont.

The threatened strike of employees on the Brantford Municipal Railway has been averted, the men accepting the new rates of pay offered by the city, namely, 29, 31 and 32 cents an hour. The old rates were 23, 25 and 26 cents an hour.

Esteven, Sask.

It is stated that a government plant for the manufacture of lignite briquettes will be established near Estevan, in the near future. It is further reported that the plant will cost $400,000 and be in operation by next winter.

Fort William, Ont.

Women conductors are a possibility on the Fort William electric railway shortly.

Gladstone, Man.

The town council of Gladstone, Man., contemplates the installation of an electric lighting and power system.

London, Ont.

Employees of the London Street Railway Company have been granted a new wage schedule of 30, 32 and 35 cents an hour. Formerly the highest rate was 28 cents an hour. By the new agreement the men also get 10 cents more per hour for overtime.

Newcastle, N.B.

The town council of Newcastle, N.B., have raised the electric light rates from 15 to 20 cents per kw.h. A discount of 20 per cent. is allowed for prompt payment.

Ottawa, Ont.

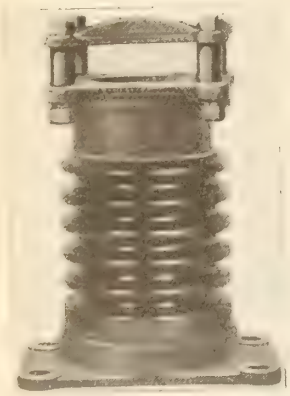
It is not impossible that in the near future the citizens of Ottawa, Ont., will be requested to vote on the question of purchasing the Ottawa Electric Railway. Figures given in the last annual statement of the company indicate that it was the most successful year in the company's history. Gross earnings amounted to $1,240,627; total expenses were $830,961, leaving a net surplus of $409,665. Passengers carried numbered 29,347,692 and dividends amounting to 15 per cent. were paid.

Regina, Sask.

A committee has been appointed by the city of Regina, Sask., to enquire into the efficiency and management of the street railway department. The scope of the enquiry will cover the handling of tickets and money, accounting, traffic organization, efficiency of employees, track and equipment maintenance.

In our last issue it was stated that the light and power rates in the city of Regina would be increased 10 per cent. and that the plant had been operating at a loss. Our source of information proved inaccurate, however, as we have been since advised that this plant has not operated at a loss for twelve years but, on the contrary, has turned over a very substantial surplus each year to lower the tax rate of the city—in 1915, $54,917; 1916, $57,061, and 1917, $24,005. The object of increasing the rates is to provide for a surplus after meeting the increased cost of coal and labor—the advances being approximately 40 per cent. since the light and power rates were fixed.

Safeguard the One Vital Point in the Central Station—*the bus bars*



OTHER individual parts of the equipment may fail or be destroyed—but as long as your switchboard and main bus bars remain intact, you can redistribute the load and keep the power flowing.

Franklin Bus Bar Supports combine great mechanical strength, great electrical strength, with sound engineering design and the finest workmanship. They have many superior features.

Consider most carefully the bus bar supports you install.

INSTALL THE "FRANKLIN" AND FORGET IT! ELECTRICAL DEVELOPMENT AND MACHINE CO. TRADE MARK GENERATING STATION EQUIPMENT

WRITE FOR BULLETINS
- Franklin Cable Potheads
- Franklin Post Type Insulators
- Franklin Bus Bar Clamps
- Franklin Disconnecting Switches
- Franklin Cleat Type Insulators
- Franklin Compartment Doors
- Franklin Compression Fuse Switches
- Franklin Instrument Cutout Switches
- Franklin Air Pressure Relays
- Reverse Phase Relays
- "Maxum" Grounding Box

Install the FRANKLIN and forget it

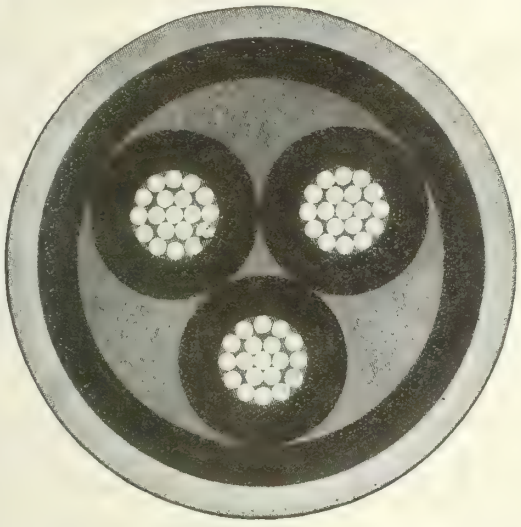
SELLING AGENTS

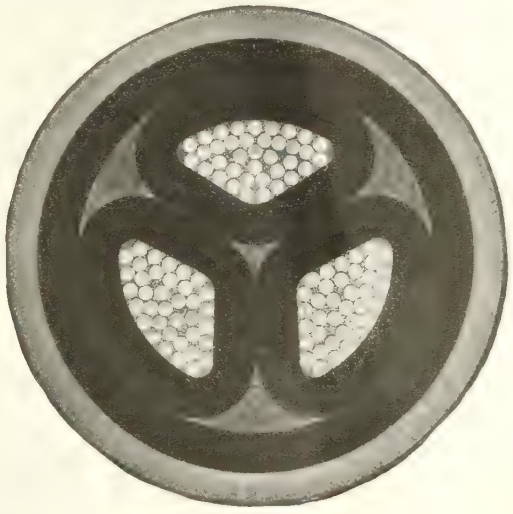
The Philadelphia Electric Company Supply Department

132 SOUTH ELEVENTH STREET PHILADELPHIA, PA., U. S. A.

PHILLIPS' CABLES

as supplied to the Toronto Hydro Electric System





These illustrations show cross sections in the original size of cables recently supplied to the T. H. E. System and reordered by them for further extensions. The specifications are as follows.—Conductors composed of 37 strands each, .082 in. diameter. Thickness of dielectric on each conductor, .210 in. Thickness in belt, .210 in. Thickness of lead sheath, .160 in. Overall diameter, 2.61 in., 250,000 C.M. Three Conductor, Paper Insulated, and plain Lead Covered Cable for 13,200 volts. We can supply you with wires and cables of any size for Power, Lighting, Telephone, Telegraph, etc.

Write us for detailed information.

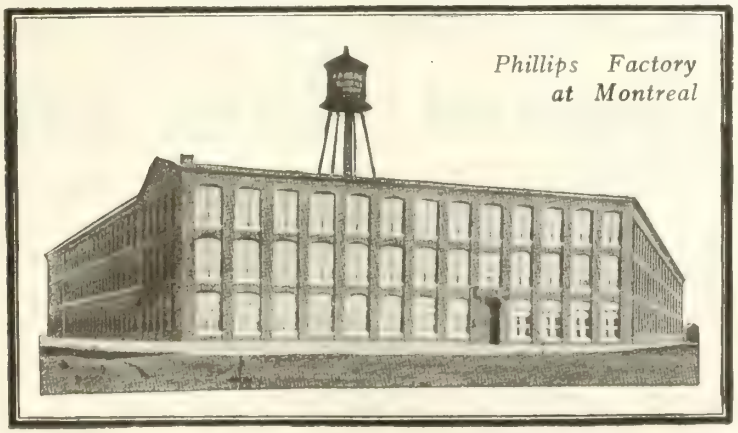
NOTE.—Specification of cable in left-hand cut: 3/0 B. and S. Three conductor. Each conductor 19 strands, each .094 in. diam. Thickness of dielectric on each conductor, .21 in. Thickness of dielectric on belt, .21 in. Thickness of lead sheath, .15 in. Overall diameter, 2.60.

Specification of cable in right-hand cut: As stated in copy.

Eugene F. Phillips Electrical Works, Ltd.

Head Office and Factory: MONTREAL

Branches: Toronto Winnipeg Regina Calgary Vancouver



Phillips Factory at Montreal

PARLIAMENT BUILDINGS, OTTAWA

Tenders Wanted for Lighting Fixtures

Sealed tenders will be received by the undersigned until noon, July 2, 1918, for the lighting fixtures required in the reconstruction of the Victoria Building.

All tenders to be based on the execution, installation and completion, together with the furnishing of all material, tools, appliances, labor, etc., necessary and as required and described by the plans, specifications and schedule for lighting fixtures.

The work of this contract shall be proceeded with as indicated in the Schedule or as may be directed and in such a manner as to ensure the completion thereof by November 1, 1919.

Plans, Specifications, Schedule and any other information required can be obtained at the office of the General Contractors, P. Lyall & Sons Construction Company, Limited, Ottawa, Ontario.

Each tender must be accompanied by an accepted cheque on a chartered bank, payable to the order of the Minister of Public Works, for a sum not less than five per cent. (5 p.c.) of the amount of the tender, which will be forfeited if the parties tendering decline to enter into a contract when called upon to do so. If the tender is not accepted the cheque will be returned. If the tender is accepted an additional cheque for a sum equivalent to five per cent. (5 p.c.) of the amount of the tender must be deposited before the contract is signed. The total security will be forfeited if the contractor fails to complete the work contracted for.

Payments for material will be made monthly. Samples must be submitted with tender.

The lowest or any tender not necessarily accepted.

Envelopes containing tenders to be marked "Tenders for Lighting Fixtures," and addressed to the undersigned.

JOHN A. PEARSON, Architect,
J. O. MARCHAND, Associate.
Centre Block, Parliament Hill,
Ottawa.

FOR SALE

Electric Light Plant in good town, divisional point in Alberta, exclusive franchise, good rates and good load. Reason for selling, owners interested in other business. Box 746, Electrical News, Toronto. 12-13

MOTOR FOR SALE

Type C., constant speed, 100 h.p., 225 ampere per terminal, 2 phase, full load speed 580, alternating 720.

Apply Armour & Co., Wentworth St. North, Hamilton, Ont. 12-14

FOR SALE

Ninety House Service Meters, well-known make. Have been thoroughly overhauled. $4.50 each. Box 745, Electrical News, Toronto. 12-12

FOR SALE

1—Madison Williams 30 in.; 200 h.p. Triumph Horizontal Steel Case Turbine Water Wheel, 25 ft. head, complete with pulley.

1—60 kilowatt, 2300 volt, 3 phase, 60 cycle, 1200 r.p.m. belted generator with pulleys and rheostats and exciter, Crocker-Wheeler make.

8,166 pounds No. 6 B&S hard drawn bare copper line wire.

1,048 pounds No. 14 B&S hard drawn bare copper line wire.

N. E. CARRUTHERS,
Secretary-Treasurer.
Lacombe, Alta.
May 11, 1918. 11-12

POSITIONS VACANT

Help Wanted

Electrical machinist, familiar with delicate instruments; first class only. Apply by letter to Hydro Laboratory, Meter Dept., 8 Strachan Ave., Toronto. 12-12

Wanted—Experienced man, returned soldier preferred, to act as Meter Reader and Inspector. Apply, stating experience, to Smiths Falls Hydro-Electric System. 12-t.f.

PETRIE'S LIST

of New and Used

MOTORS

FOR IMMEDIATE DELIVERY

No.	H.P.	Phase	Cycle	Volts	Speed	Maker
1	100	3	25	550	750	Westg.
1	35	3	25	550	720	Westg.
1	30	3	25	550	710	C. G. E.
1	25	3	60	2000	900	C. G. E.
2	25	3	25	550	750	Westg.
2	20	3	25	550	500	C. G. E.
1	15	3	25	550	750	C. G. E.
1	7½	3	25	550	750	C. G. E.
2	4	3	25	550	1400	Excelsior
3	3	3	25	550	1400	Excelsior

30 to 60 DAYS' DELIVERY

2	75	3	25	550	750	C. G. E.
1	35	3	25	550	750	C. G. E.
1	25	3	25	550	750	C. G. E.
3	10	3	25	550	750	Westg.
1	7½	3	25	550	750	C. G. E.
4	5	3	25	550	750	Westg.

Write Us for Prices

H. W. PETRIE, Limited
Front St. West - Toronto, Ont.

READ THIS!

$2,900 for

275 K.V.A. 25 Cycle
6600 Volt, 3 Phase
275 R.P.M. Generator
or Synchronous Motor

Brand New

Fully Equipped Sw-Bd. and Exciter

ALSO

3—100 K.V.A. 25 Cycle
New Transformers S.P.
13,200 to 6600/2200 Volt
$900 each

To be sold immediately

Wire for particulars

E. A. LOWRY - GUELPH, ONT.



Rubber Covered Wires and Cables

FOR POWER, LIGHT AND TELEPHONE WORK

Incandescent Lamp Cord, Flexible Switchboard Cables, Special Cords and Cables for all kinds of Electrical Work.

Prompt Shipments from Canadian Factory.

BOSTON INSULATED WIRE & CABLE CO., Limited

Canadian Office and Factory, HAMILTON, ONT.

Ready for Immediate Delivery

ALTERNATING CURRENT

—100 K.W., General Electric, 3 phase, 60 cycle, 2300 volt generator, type GTB, form D, complete with switchboards.

—200 KW., 3 phase, 60 cycle, 1100 volt, General Electric generator, type GTB, form D, speed 600.

—450 K.V.A., 2300 volt, Allis-Chalmers, 200 speed, 3 phase, 60 cycle generator, 2 years old, good for direct connection for engine drive or water wheel drive.

—100 H.P. new Westinghouse motor, 3 phase, 60 cycle, 550 volt. 900 speed.

—100 H.P., new General Electric, 3 phase, 60 cycle, 440 volt, 720 speed, slip ring, complete for heavy starting duty.

1—50 H.P. new General Electric, 440 volt, 1200 speed, 3 phase, 60 cycle, slip ring motor.

1—50 H.P. General Electric, 220 volt, 900 speed, type I, form L.

2—50 H.P. new Allis-Chalmers, 550 volt, 3 phase, 60 cycle, 900 speed motors.

MOTOR GENERATOR SET

1—40 KW., 125 volt, General Electric, 720 speed, type CL, form B, 6 pole generator, connected on one sub base to a 60 H.P., 3 phase, 60 cycle, 2080 volt, 720 speed, type M, form C, Fort Wayne motor in A1 condition and complete. Three bearing machine.

DIRECT CURRENT

2—100 H.P., 110 volt, Holtzer-Cabot D.C. motors, 550 r.p.m., full commutators.

1—10 KW., 125 volt, Bullock, 400 speed, marine set, direct connected on one sub base to a Westinghouse vertical engine.

1—50 KW., 125 volt, General Electric, 280 speed, type MP generator, direct connected to an 11 x 12 vertical marine type engine.

1—300 KW., 500 volt, D.C. General Electric generator, 400 r.p.m.

1—56¼ KW., 125 volt Westinghouse, 800 speed, type M generator, complete and in A1 condition.

1—80 KW., 125 volt, Crocker-Wheeler, 750 speed, type CCD generator.

1—90 KW., 110 volt, General Electric, 690 speed, type CL, 6 pole, form B generator.

1—300 KW., 550 volt, General Electric, 400 speed, type MP generator, D.C.

BOILERS

3—300 H.P. Holyoke Manning Boilers, now located in Massachusetts; good for 150 lbs; 11 years old, in splendid condition.

5—150 H.P. Manning Boilers, now located in New Hampshire; good for 135-140 lbs. Immediate delivery.

6—90" x 18' 6" horizontal return tubular Dillon Boilers, now located in Rhode Island, installed in 1905, for delivery in 2 months.

SEND US YOUR ENQUIRIES

JOSEPH MYERSON, 274 Commercial St., **BOSTON, Mass.**

Selections from Our Stock of Motors
3 Phase, 60 and 25 Cycles

3 PHASE, 60 CYCLE MOTORS

Qu.	H.P.	Make	Volts	Type	Speed
1	¼	R&M	NEW. 110		1700
1	½	G.E.	NEW.. 110	KT	1800
1	½	G.E.	 110	I	1800
5	1	G.E.	NEW . 220	KT	1800
1	1	G.E.	 220	KT	1800
1	1	Fbks. M.	... 440	B	1200
1	2	G.E.	 220	KT	900
5	2	G.E.	NEW . 220	KT	1800
5	3	Wstgh.	New. 220	CS	1130
2	3	R&M	NEW. 220		1150
3	3	G.E.	 220	KT	1800
6	3	G.E.	NEW . 220	KT	1200
1	3	G.E.	220	KT	900
3	3	G.E.	 220	KT	1200
3	3	Cr. Wh.	 220		1720
6	5	G.E.	NEW . 220	KT	1800
3	5	Cr. Wh.	... 220	Q	1720
1	5	Cr. Wh.	... 550	Q	1720
1	5	Wstgh.	 220	CCL	1700
9	5	Wstgh.	New 220	CS	1735
1	5	Wstgh.	New 220	CS	1130
53	7	G.E.	(motors only) 550		1200
1	7½	15 Cr. Wh.	220/440		865/1735
2	7½	G.E.	NEW . 220	KT	1800
1	7½	G.E.	NEW . 220	KT	1200
6	7½	G.E.	(motors only) 550	KT	1800
2	7½	G.E.	NEW . 220	KT	900
2	10	G.E.	NEW . 220	KT	1800
4	10	G.E.	NEW . 220	KT	1200
1	10	Wstgh.	 220	CCL	1700
1	10	Wstgh.	 220	CS	1150
1	10	Cr. Wh.	with resistance type starter 550	Q	1800
1	10	G.E.	 220	L	1200
1	10	Robbins & M	220	K	1750
1	15	G. E.	 220	I	900
1	15	Wstgh.	 220		1155
2	15	G.E.	NEW . 220	KT	900
2	15	Fbks. M.	220/440	KBV	1200
2	20	Wstgh.	 220	CS	1160
1	20	Fbks. M.	 220	B	1200
50	20	Fbks. M.	220/440	KBV	1200
19	25	Wagner.	220/440	BP	1120
2	30	Wagner	New 220		850
1	35	G.E.	 220	KT	690
1	35	Triumph.	220/440		900
1	40	Wagner	NEW . 220/440	BP	850
1	40	Fbks. M.	 220		900
1	35	G.E.	NEW . 220	M	900
1	35	Westgh.	 220		1170
1	40	Westgh.	New 220	CS	870
1	50	Westgh.	 220		860
1	50	Triumph	 220		720
1	75	Westgh.	New 440	CS	720
1	100	Westgh.	 440		1200
1	125	G.E.	 220	L	690
1	150	G.E.	NEW. 220	CW	695
1	150	G.E.	NEW . 220	M	580

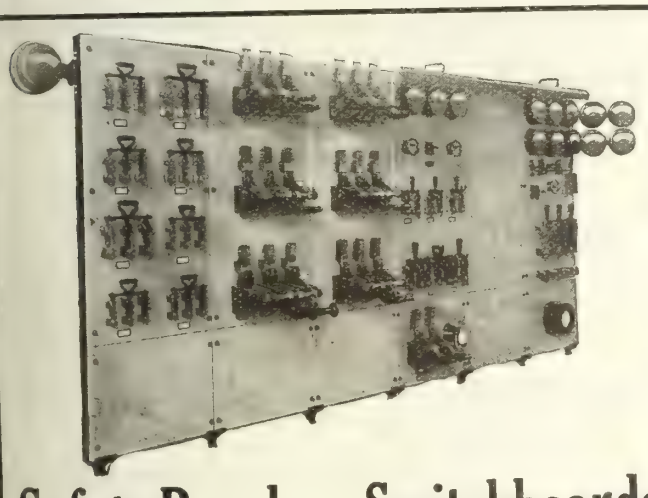
3 PHASE, 25 CYCLE MOTORS

7	2 5	Westgh.	... 220	CCL	705
1	12½	G.E.elev.type-high torque	220	KTE	750
6	15	Allis-Ch.	.. 220		750
7	20	Allis-Ch.	.. 220		750
1	20	G.E.	 440	K	750
1	40	Wstgh.	. . 220	MW	695
1	50	Allis-Ch. intermittent duty, sl. rg. drum controller 440			500
1	55	Wstgh.sl.rg. 30 cycles, complete. . 440			860
1—60/45/30 G.E. 440					500 375 250

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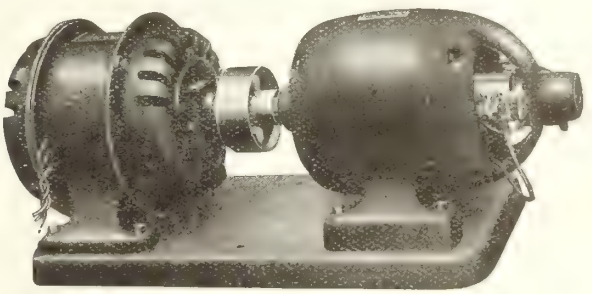
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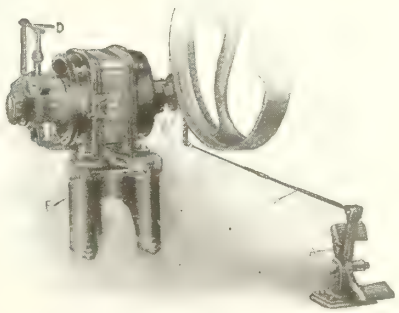
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Kraft Cord "Braiduct"

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This cut is reproduced from an actual photograph, and illustrates the behavior of the material in this rigid test—perfect flexibility. We cut the ends to show plainly the superior construction—note the high grade Canvas Duck Lining and the KRAFT CORD winding. This KRAFT CORD is made to our own specifications and is fire-proofed, which is entirely new.

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We are now making our own insulating compounds, consequently every lot will be uniform in flexibility, and every foot is fished at the factory.

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KRAFT CORD "BRAIDUCT" tests far above all requirements of the Underwriters.

We will be glad to send you a sample.

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The Superintendent of one of the largest electrical contracting firms writes us:

"The workmen have formed the habit of using Dossert Connectors for all kinds of connections and consider it a hardship if they are called upon to perform the tedious and laborious task of making a soldered joint with its attendant acid fumes, gasoline torch smoke and burned fingers."

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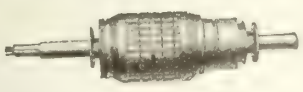
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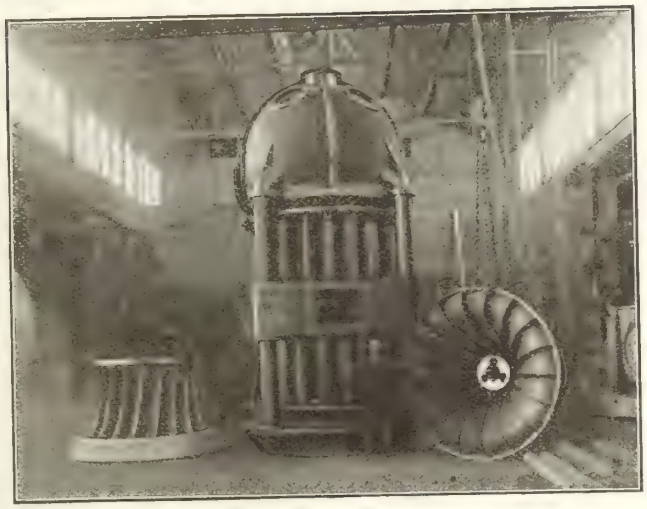
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Vertical Turbines

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The services of these experts are at your disposal to consult on any of your engineering troubles.

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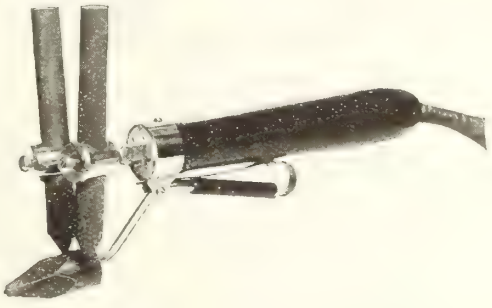
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The New

J.C. Electric Soldering Iron

3 1/2 Hours Saved on a 5-Hour Job!

(70 per cent. saving)



Instead of taking 5 hours to solder the terminal leads of the stator coils of this motor the J. C. Soldering Iron cut this time to 1½ hours—a saving of 3½ hours. The secret of the efficiency of this remarkable Iron is the fact that it heats only while in contact with the work, and then heats almost instantaneously.

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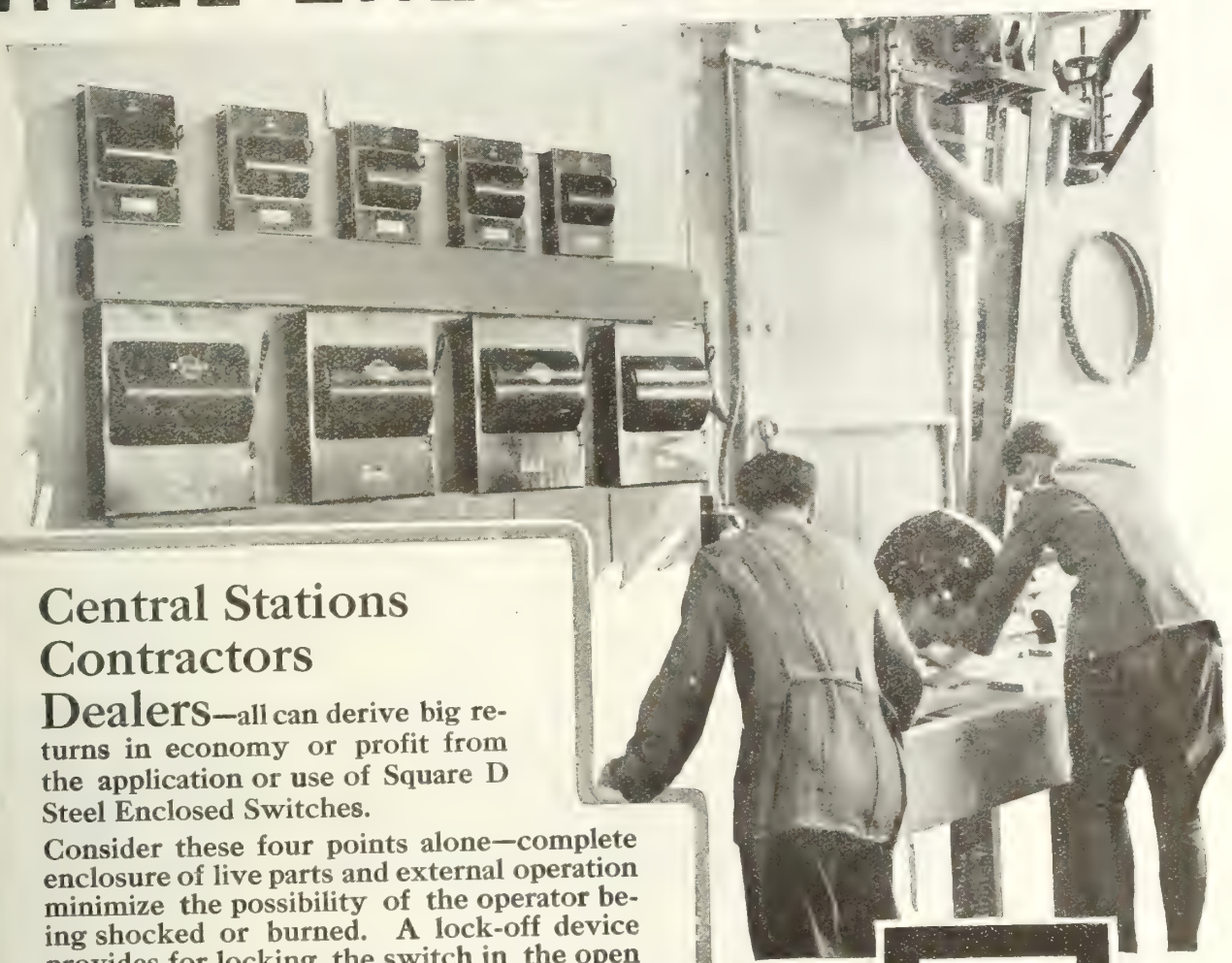
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(Continued on Page 50)

SQUARE D

STEEL ENCLOSED SWITCHES



Central Stations
Contractors
Dealers—all can derive big returns in economy or profit from the application or use of Square D Steel Enclosed Switches.

Consider these four points alone—complete enclosure of live parts and external operation minimize the possibility of the operator being shocked or burned. A lock-off device provides for locking the switch in the open position to guard against the accidental closing of the circuit.

Fire hazards and insurance costs reduced to a minimum. Motors, workmen and equipment are protected, ensuring maximum production and increased satisfaction among employees.

Be satisfied with nothing less than Square D—the original steel enclosed switch.

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THE ORIGINAL SAFETY SWITCH

SQUARE D SWITCHES

do not hinder production

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National Electric Heating Company

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Weston Electrical Instrument Company

STORAGE BATTERIES
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Canadian Hart Accumulator Company
Northern Electric Company

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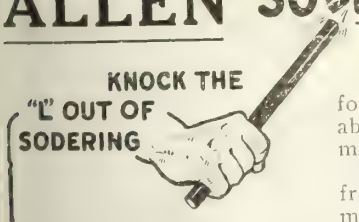
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Head Office and Works

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Use ALLEN Fluxes—for safe, strong, dependable sodered joints—any metal to any metal.

It frees the sodering job from uncertainty and will make a beautiful joint where everything else has failed.

Non-acid—Non-corrosive—Non-poisonous. Makes a joint nearly three times as strong as muriatic acid.

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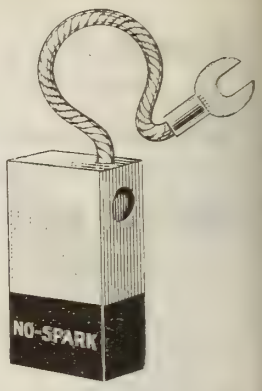
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Kuhlman Electric Co.
Bay City, Mich.

The Chief Benefit

derived from

"No Spark"



CARBON BRUSHES

IS FREEDOM FROM TROUBLE REPLACING AND RESETTING BRUSHES. Being self-lubricating, they make the contacts practically frictionless and reduce commutator repairs enough to pay for themselves several times over. With these carbon brushes, the machine runs noiselessly without any sparking. These are facts which you can at once prove.

Write for our latest Bulletin

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Conduit

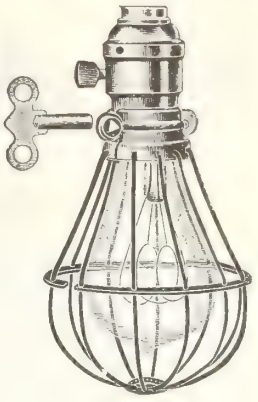
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Orpen Conduit Co., Limited
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THE LOXON INVENTION



prevents loss by theft or breakage.

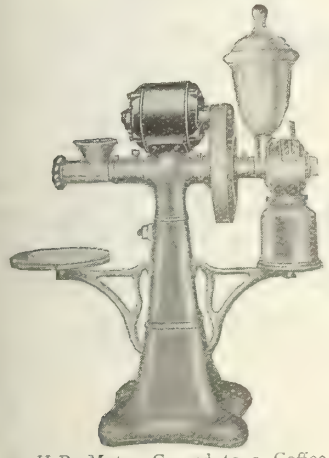
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¼ H.P. Motor Geared to a Coffee Mill and Meat Chopper

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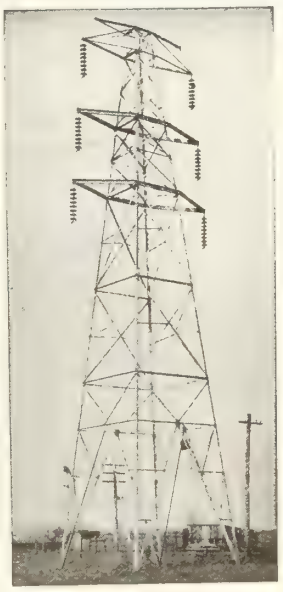
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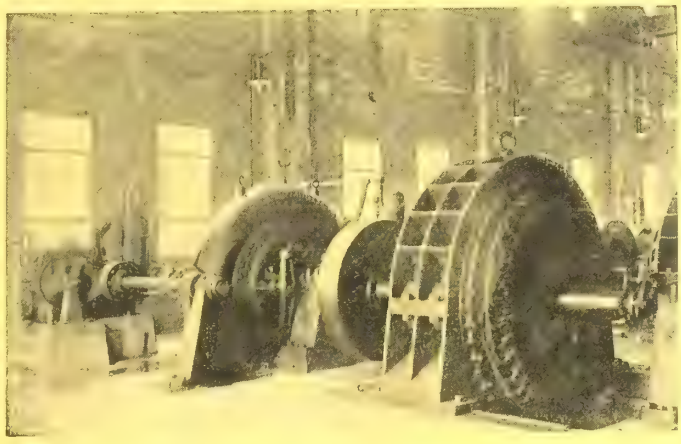
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A Lost Opportunity

As a wiring contractor, how many times have you turned down orders to repair the Motors or dynamos of your customers and let them send their work to the maker?

How much have YOU lost in prestige through not being able to take care of your customers' business?

How much have YOU lost in Profit on this business?



Get the habit of handling these repairs. Send them to a Specialist in Repairs. Don't send them to the maker. Your customer can do that, and he's already sick of it. The service is too slow. He wants quick work and an absolutely reliable job. You can give it to him.

Make up your mind now. Say "I'm going to get something out of the next repair job in this town."

You have the work of taking out and re-installing the machine (Profit). Send us the machine or part with a description of its action or symptom. We'll rush it through for you, give you an A1 job and you come in again on the Trade Discount (More Profit).

Others are doing it. Why not you? Write about it.

The Electrical Maintenance & Repairs Company, Limited

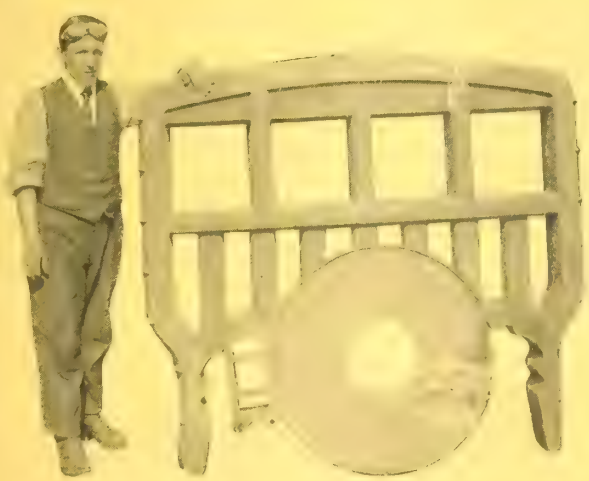
Phones:
Adelaide 902
Adelaide 903

162 Adelaide Street West, Toronto
"ALWAYS ON THE JOB"

Nights and Holidays
R. B. Rothwell, Supt., Beach 1930
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OXY-ACETYLENE WELDING & CUTTING

2 Boiler Sections Reclaimed



Welding these two Boiler sections saved over $100, being the difference between the cost of replacing them and the cost of the repairs, but their value during the time that would have been lost in waiting for replacements makes the actual monetary gain even more apparent.

These are ordinary repairs of every day occurrence. There are many similar uses for the Process in your Industry and the actual money saved by the installation of an Oxy-Acetylene Welding Plant would reduce the initial cost to insignificance.

Ask for further particulars

L'AIR LIQUIDE SOCIETY

Manufacturers, in Canada, of all requisites for the Oxy-Acetylene Process.

TORONTO. MONTREAL. WINNIPEG. HALIFAX.

GET THE GENUINE

Look for the Name

WHITE'S PORCELAIN STRAIN INSULATORS

You want strain insulators that are strong physically, that stand up under the exceptional conditions of the heavy storm; that hold up under a load of sleet; that don't crack when the thunder rolls, the lightning flashes, and the wind whistles.

This is the kind of strains T. C. White Company is making of porcelain in a variety of sizes for different loads, and several designs for varying conditions.

It will pay you to write for bulletin which shows designs and gives the complete data on strain and electrical tests.

Write today.



Type No. 600

T. C. White Electrical Supply Co., 1122 Pine Street, ST. LOUIS, Mo.



National ELECTRIC

Every home needs an Electric Circulation Water Heater.

There are more National Electric Circulation Water Heaters sold in Canada than any other make.

There is a reason

Have you a stock to meet the demand? If not communicate with your nearest jobber or direct with us.

The National Electric Heating Co., Limited

TORONTO, CANADA

Vol. XXVII No. 13 Toronto, July 1, 1918

Electrical News

Generation, Transmission and Application of Electricity

Are You Wasting Water Power

Through Inefficient and Antiquated Equipment?

SMITH
Hydraulic Turbines
Are the Result of
FORTY YEARS
OF
SPECIALIZATION
IN
DESIGN
AND
MANUFACTURE
OF
WATER
POWER
EQUIPMENT



The accompanying illustration shows a Single Vertical Shaft, Wicket Gate Turbine, mounted in cast iron spiral flume, direct connected to generator. 4000 H. P. Capacity at 375 R.P.M. under 122 ft. head.

One unit in successful operation. Second unit now being installed in Wawaitin Plant of Northern Canada Power Company, Limited, Timmins, Ont.

If interested in Water Power Development, write Dept. "N" for Bulletin of Designs

S. MORGAN SMITH CO., York, Pa.

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Electrical Convention Reports

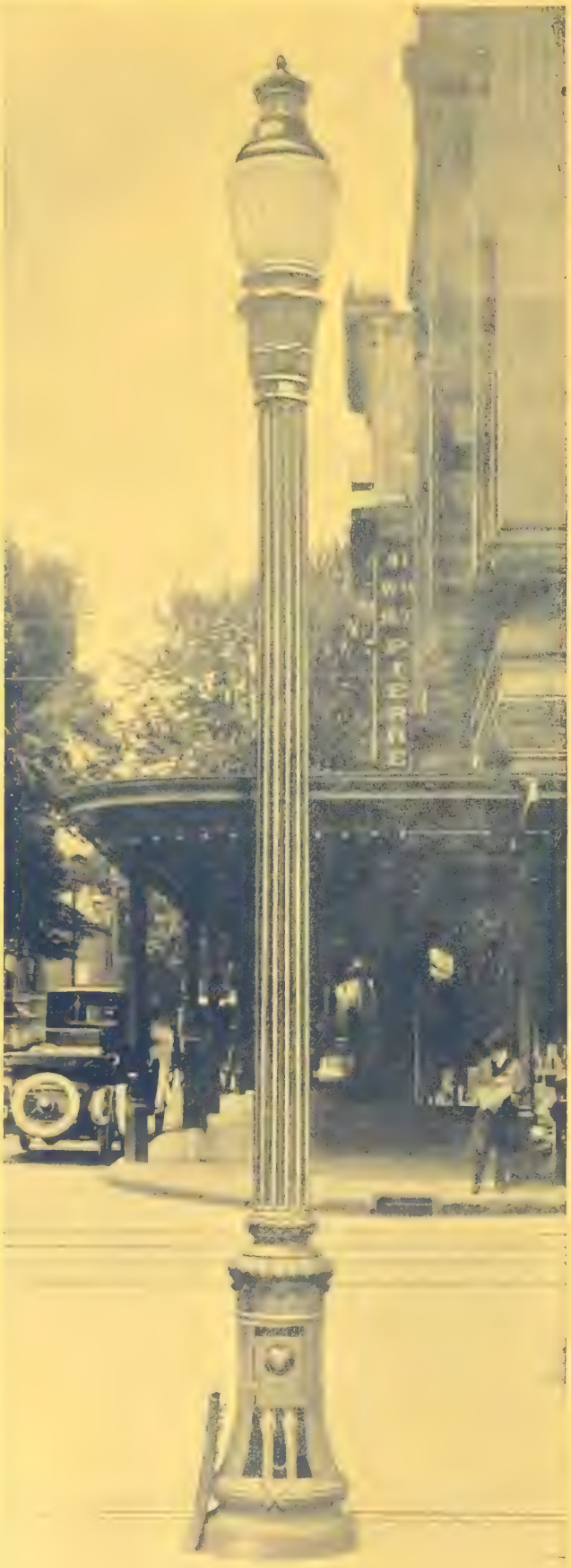


FIGURE 3



FIGURE 1—FRONT



FIGURE 2—REAR

THE "S.J.B." BOX

FOR SERIES ORNAMENTAL STREET LIGHTING SYSTEMS

¶ To provide a means of disconnecting lamps from circuits supplied with current by two-conductor cable, The Northern Electric Company have recently designed the "S.J.B." Box for use on series circuits operating at potentials of 7,000 volts or less.

¶ Figs. 1 and 2 show front and rear views of the box, and Fig. 3 shows how the box is installed in the pedestal of a lamp standard. This view was taken in Montreal where all of the standards used in connection with the new lighting system are equipped with these boxes.

¶ There are many interesting features in connection with this box, but the limited space at our disposal does not permit of a detailed explanation. To those interested, however, we will be glad to send photographs and full descriptive matter on application to our nearest branch house.

Northern Electric Company
LIMITED

MONTREAL HALIFAX TORONTO WINNIPEG
REGINA CALGARY VANCOUVER

HUGHES
Electric Ranges

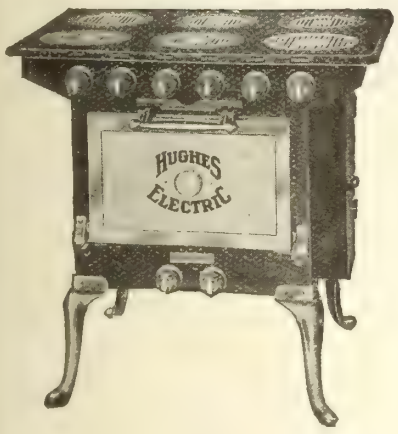


No. 50

HUGHES "50" ELECTRIC RANGE

This is one of the most popular styles of ranges on the market. Ideal for homes, suitable for medium or large size family, also for Clubs, Church Kitchens, etc.

Features, 4-burner cooking surface, 2-burner oven, warming compartment, outside warming shelf, lower outside shelf. Finish either plain or nickled with white enamel splashers.



No. 48

HUGHES "48" ELECTRIC RANGE

Extremely handy; designed for large families, boarding houses, restaurants, hotels, clubs, etc., where a greater cooking capacity is required in a small space.

Features, 6-burner cooking surface, 2-burner oven. Finish either plain or nickle plated.

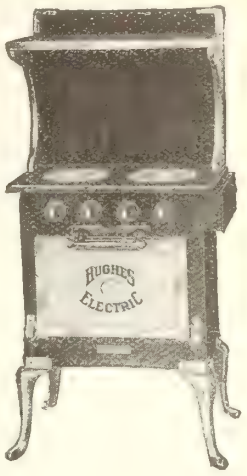


No. 44

HUGHES "44" ELECTRIC RANGE

A very popular range because it uses little floor space and has elevated oven, exclusively for families of average size.

Features: 4-burner cooking surface, 2-burner oven, lower outside shelf. Finish either plain or nickle plated.



No. 27

HUGHES "27" ELECTRIC RANGE

The most desirable Range for small or medium size families with limited kitchen space.

Features, 2-burner cooking surface, 2-burner oven, elevated outside warming shelf. Finish either plain or nickle plated.

Electricity Makes Cooking Scientific and Economical

SCIENTIFIC—because they have introduced and adopted, virtually, every fundamental improvement in the development of the modern electric range—the most complete line of electric cooking apparatus in the world.

ECONOMICAL—because of economy of current, of food, of time and trouble. The HUGHES ovens are so constructed as to make it possible to turn off the current long before the food is cooked, because it does not shrink or dry out the food it cooks, hence an appreciable saving in market bills.



No. C-18

HUGHES "C-18" ELECTRIC RANGE

It is solidly constructed of steel and cast iron, occupying floor space of only 17 x 25 inches, compact, neat, most suitable for light cooking. Finish plain black enamel.

HUGHES RANGES are sold with a year's guarantee against defects electrical and mechanical, backed by the reputation of their makers. They are without doubt the best and most economical electric ranges on the market.

Awarded GOLD MEDAL, Panama Pacific International Exposition, 1915.

Tested and approved by the Underwriters' Laboratories of the National Board of Fire Underwriters—and also by Good Housekeeping Institute.

Write our House nearest you for further information as to literature, prices, etc.

Northern Electric Company
LIMITED

MONTREAL
HALIFAX
OTTAWA

TORONTO
LONDON
WINNIPEG

REGINA
CALGARY
VANCOUVER

"Firmly seated and there to stay."



"No. 222 is a good thing to get on to."

Actual Size

222

The capping of No. 222 Molding is firmly secured to the base by a Spring Clip, No. 223, easily applied. These should be used at intervals of about 18 inches.

On your next job refer to your Bulletin 101 and place your order with your jobber.

National Metal Molding Co.

1118 FULTON BUILDING
PITTSBURGH

Atlanta, Boston, Buffalo, Buenos Aires, Chicago, Dallas, Denver, Detroit, Los Angeles, New York, Havana, Philadelphia, Portland, Salt Lake City, Manila, Paris, San Francisco, Seattle, St. Louis

Canadian Distributors—Canadian General Electric Co., Limited

M-8

Made in Canada
Conduit

XCELADUCT

(GALVANIZED)

Orpen Conduit Co., Limited
Toronto

Keystone Car Signs

Standard on the Seattle Municipal Railway

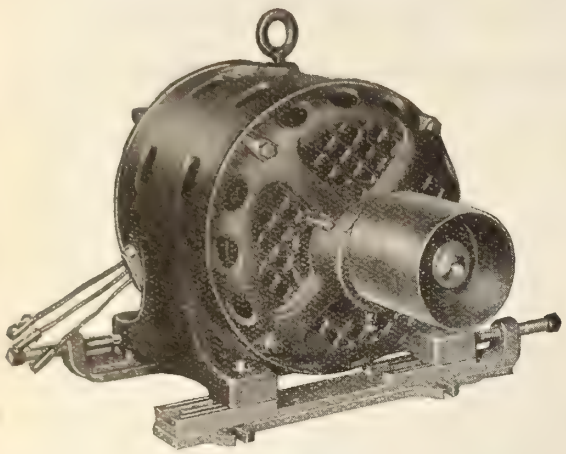


The popularity of Keystone and Hunter types of illuminated car signs is not limited by geography. They are just as greatly appreciated on the shores of the Pacific as on the Atlantic Shores.

So it's not surprising to find Keystone car signs the standard of the Seattle Municipal Railway which appreciates that car signs legible beyond braking distance cuts down unnecessary stops (due to misunderstanding by intending riders) and ADVERTISE THE SERVICE.

Electric Service Supplies Co.
Manufacturers
PHILADELPHIA 17th and Cambria Sts. NEW YORK 50 Church St CHICAGO Monadnock Bldg.

Lyman Tube & Supply Co., Ltd.
Canadian Distributors
MONTREAL Lyman Tube Bldg. WINNIPEG 302 Donalda Block TORONTO 33 Melinda St.



15 H.P. 3 Phase Motor

Century

AUTOMATIC START INDUCTION

POLYPHASE MOTORS

1/2 to 60 H.P.

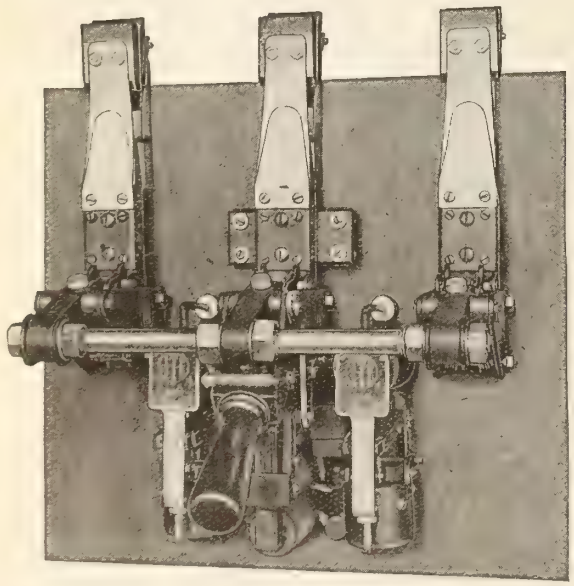
A single throw knife switch is all that is necessary to start them hence — the starting current cannot be varied by the operator.

CENTURY ELECTRIC COMPANY

ST. LOUIS, Mo., U.S.A.

Stock carried in Canada by: 306
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Great West Electric Co., Ltd., Winnipeg
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I-T-E CIRCUIT BREAKERS



TYPE W

Non closable on overload. Direct acting, time limit and "No Voltage."

For motor protection, especially A.C., 440 volts or less, the

I-T-E CIRCUIT BREAKER

has advantages not possessed by any other piece of apparatus. This is why one concern recently ordered over two hundred of them.

THE CUTTER COMPANY

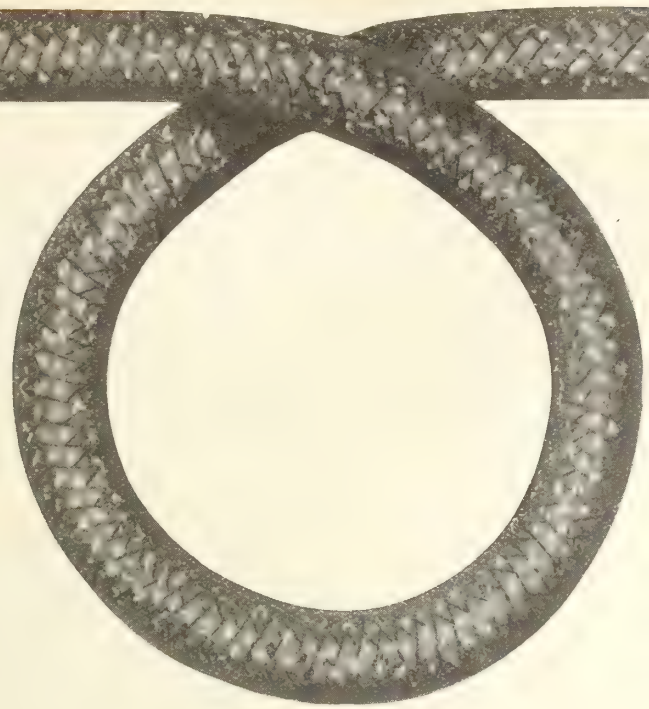
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Kraft Cord "Braiduct"

Made in Canada under Canadian Patent No. 147,057

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We will be glad to send you a sample.

The Flexible Conduit Co.

Limited

Guelph - Canada

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Useful in the Shop and Laboratory for the Measurement of Resistance. Adapted for Fault Locations in Telegraph and Telephone Lines and Cables.

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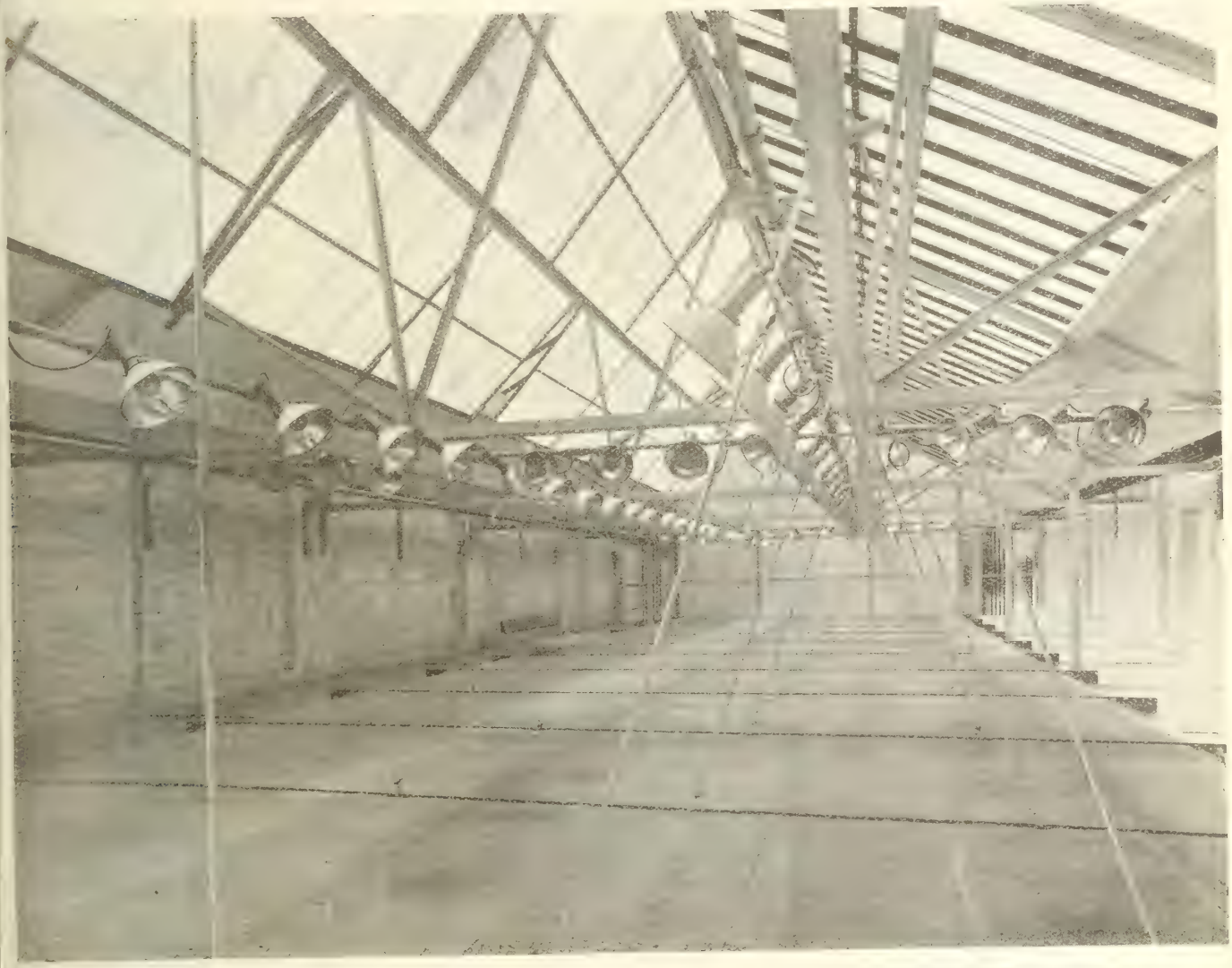
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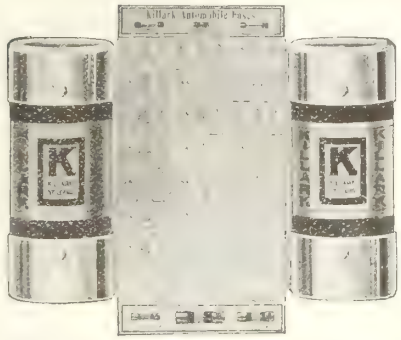
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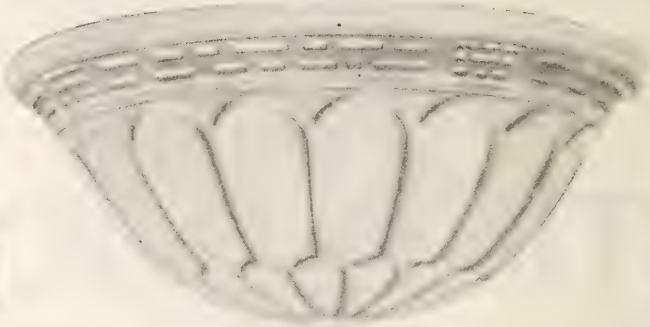
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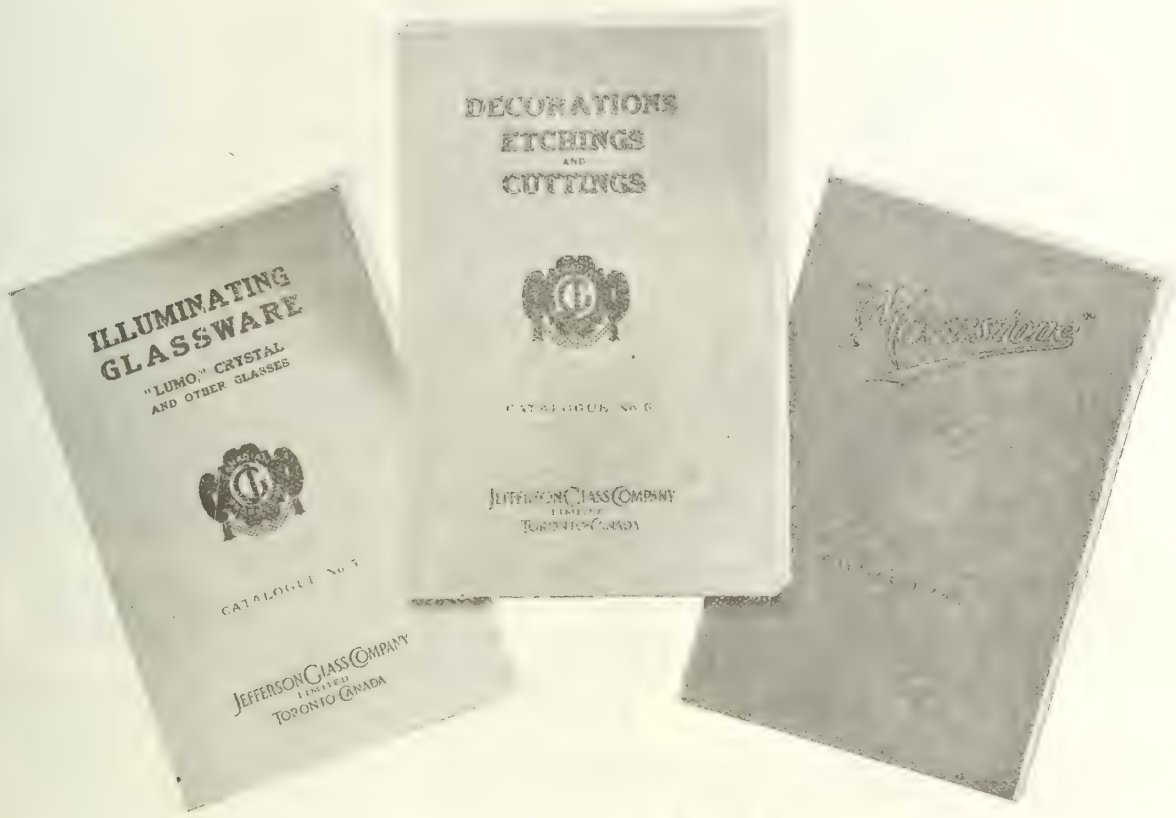
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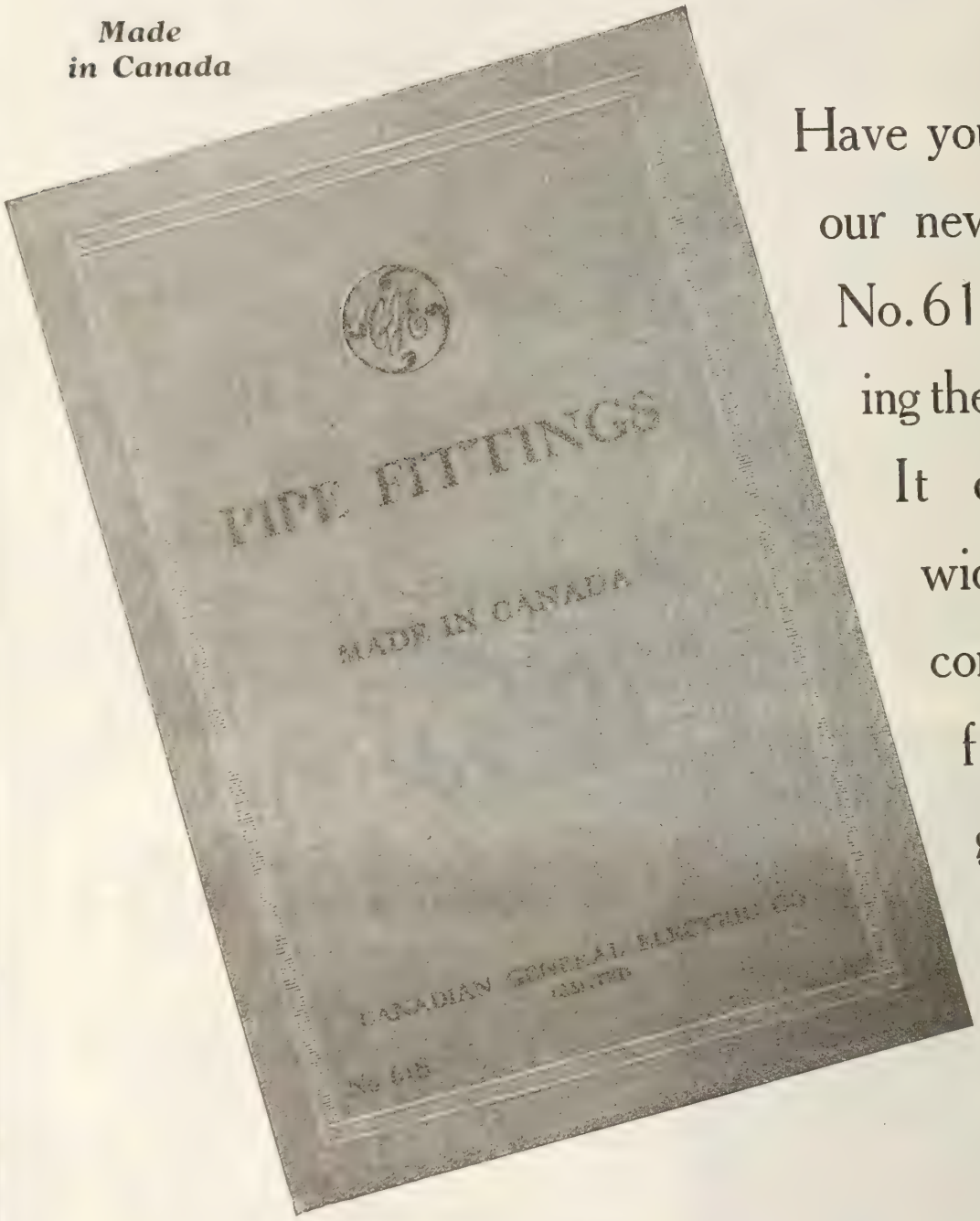
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CONDUIT PIPE FITTINGS

Made in Canada



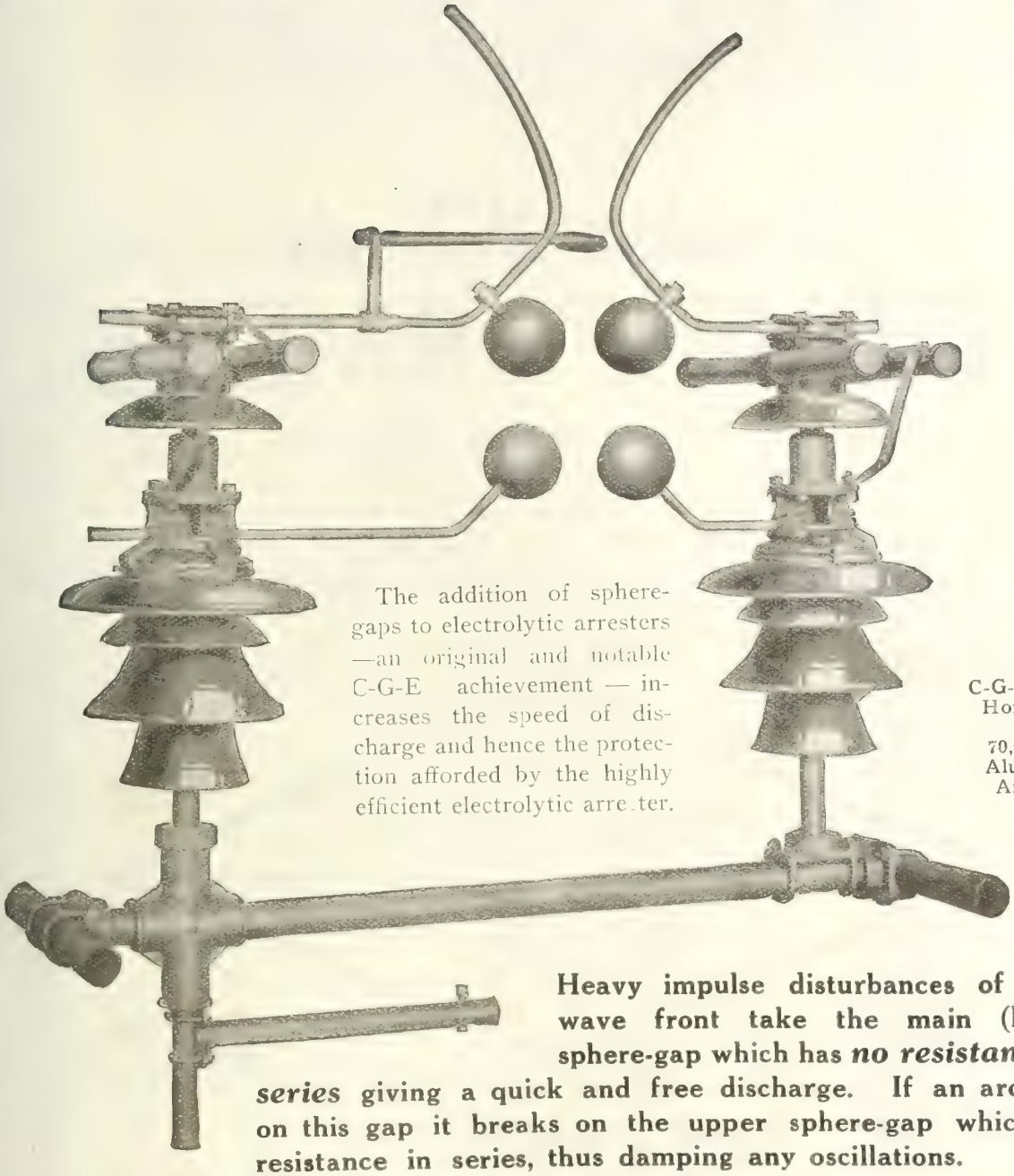
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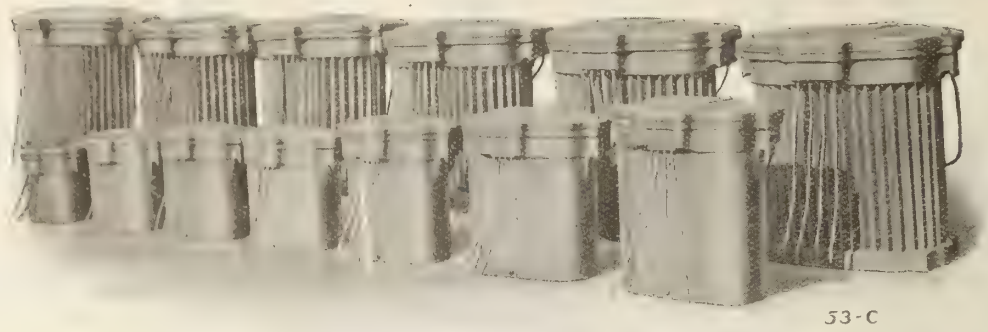
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Motor Generator Sets

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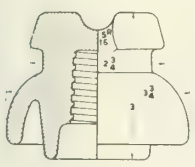
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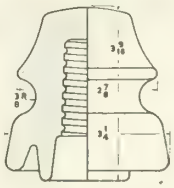
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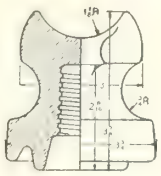
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No. 505



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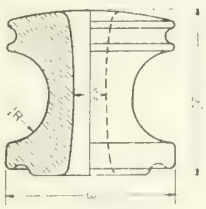


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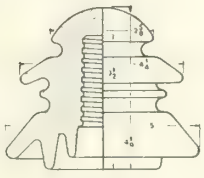
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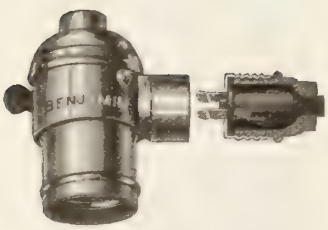


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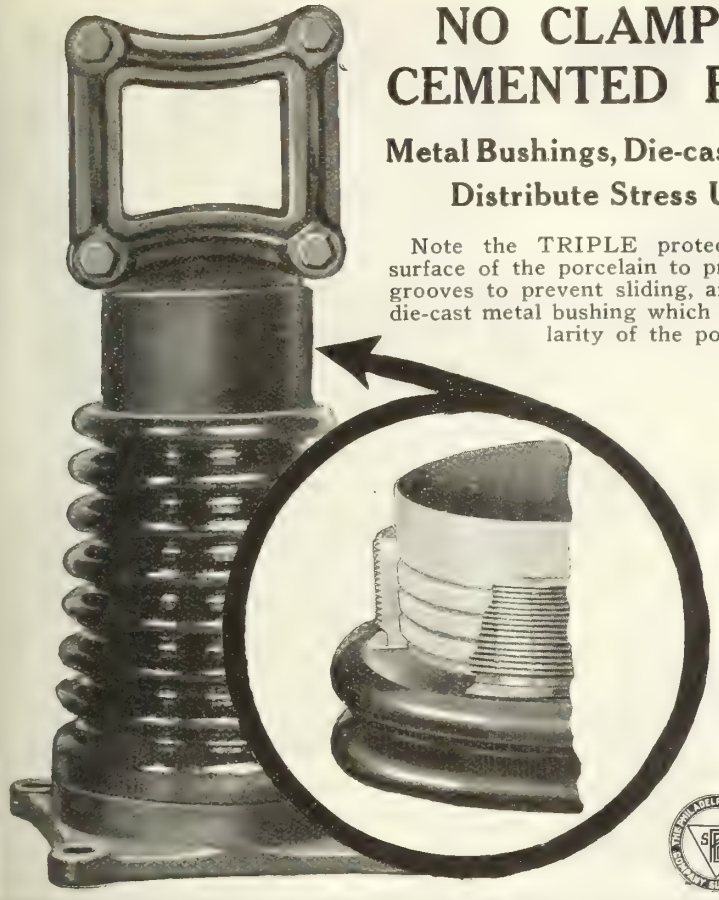


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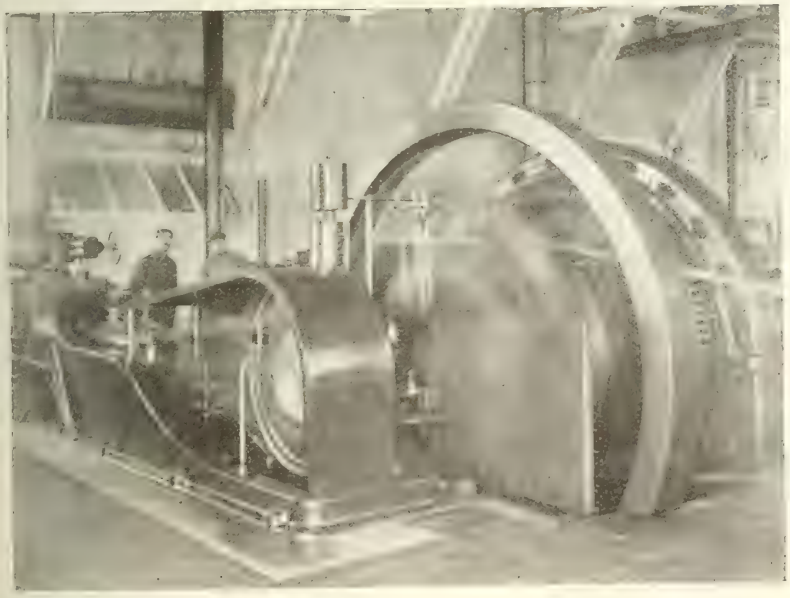
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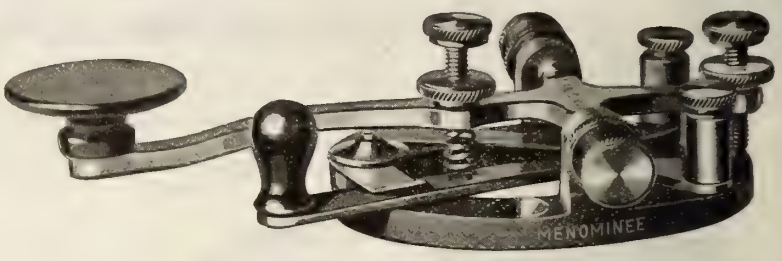
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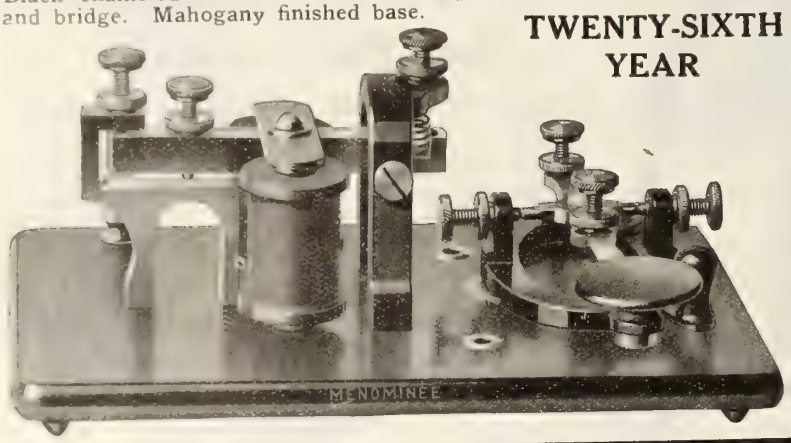
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No. M 100

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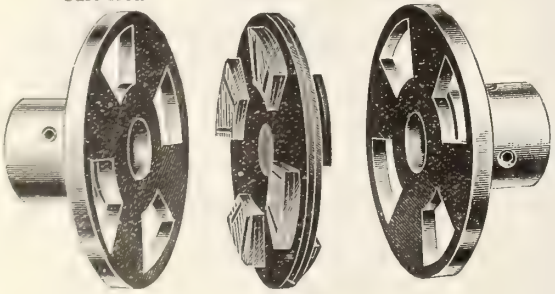
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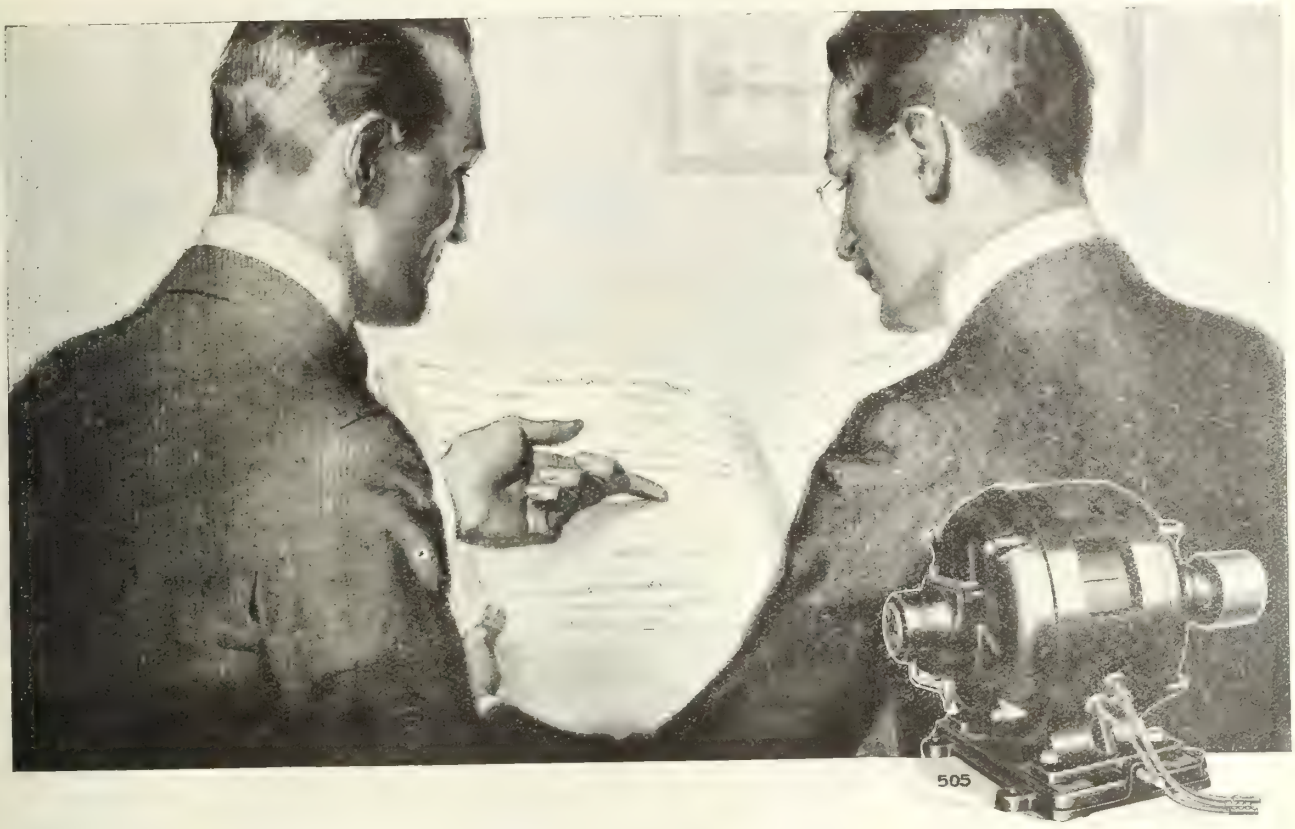
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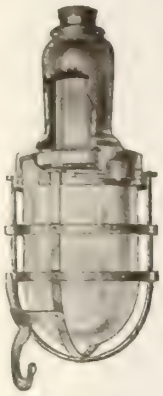
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NAVAL BRIGADE TRAINING SHIP COMMODORE JARVIS



TYPE VL MOISTURE-PROOF CONDULET



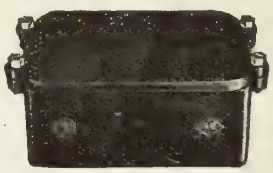
TYPE BRHD WATER-TIGHT PLUG RECEPTACLE EQUIPMENT



TYPE SCX PROJECTOR (1,000 WATT)



TYPE PNX WATER-TIGHT JUNCTION BOX



TYPE AD WATER-TIGHT JUNCTION BOX



TYPE LB OBROUND CONDULET BODY WITH BLANK METAL COVER



TYPE LR OBROUND CONDULET BODY



TYPE SDA PROJECTOR

Crouse-Hinds Company

OF CANADA, LIMITED

Toronto, Ontario, Canada

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Generation, Transmission and Application of Electricity

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Vol. 27 Toronto, July 1, 1918 No. 13

Montreal Tramways Commission Recognizes Justice of Fare Increase

The advance in wages and the high cost of materials have caused the Montreal Tramways Commission to raise the fares. The company submitted detailed information showing that the cost of material has risen from 12 per cent. to 700 per cent. in some instances. The Commission has decided that the old rate of 6 tickets for 25c and 8 workmen's tickets for the same money will be abolished, and that in what is called the uniform tariff territory the rate will be five tickets for 25c, with a cent extra for transfers, except from 5 to 8 in the morning, when transfers are free. The cash fare from 8 a.m. until midnight will be 6c, in addition to a cent for a transfer, while after midnight the cash fare will be 15c. School children will obtain 7 tickets for 25c, the tickets being available from 8 a.m. to 6 p.m., transfers free. Another schedule of rates has been fixed for districts outside the uniform tariff territory, these being generally 5c for local traffic, 10c after midnight, with the uniform tariff extra when passengers are carried into that territory. In some instances there is an actual reduction in fares from Montreal to outside points. In order to get over the inconvenience of paying for individual transfers, arrangements will be made to sell strips of transfer tickets.

In explanation of the decision, the Tramways Commission state: "The revenue to be derived from such tariffs are to provide tramways service at cost. The Tramways Commission, after a careful study of the expenditures incurred by the Tramways Company in previous years and taking into consideration the increase in labor and material, found it necessary to provide for a total revenue of approximately ten million dollars for the twelve months ending June 30th, 1919. This gross revenue exceeds the revenue of the year ending June 30th, 1917, by an amount of $2,500,000, during which period the fares averaged 4.11c per revenue passenger.

"The increased cost of wages and material, as well as the increased fixed charges due to additional capital required, brings up the estimated cost per revenue passenger to approximately 5.5c. This increase of about $2,500,000, is made up as follows:

(a) Estimated increase in wages for 13 months...	$750,000
(b) Deficit incurred since the putting in force of the contract until June 30th, 1918	400,000
(c) Estimated increased cost of material and supplies	1,000,000
(d) Additional fixed charges	280,000

Elimination of Unnecessary Shock

Winnipeg, Man., June 12th, 1918.

Editor, Electrical News:

While numerous bodies have from time to time promulgated rules for protection of property against hazardous methods of electric installation, it is only recently that any attempt has been made to grapple with the question of this danger to persons from such causes. Noteworthy efforts are, however, discernible in certain directions, such as those of the Hydro-electric Power Commission rules, which are a step in advance, and more especially the National Electric Safety Code, issued by the Bureau of Standards, Washington.

As illustrating one little point in above connection I enclose copy of a notice recently sent out by us to all manufacturers of electric ranges. There is, to my mind, no valid reason why women and children should be exposed to risk of shock in such ways as are spoken of, when they can be so easily protected. It is, I think, up to electrical engineers and plant superintendents to bring pressure to bear on this problem and insist upon the elimination of these needless hazards.

Yours truly,
F. A. Cambridge,
City Electrician.

Notice to Electric Range Manufacturers

While we have on several occasions drawn your attention to the necessity of placing the individual switches on electric hot plates and ranges on one of the "outer" wires of the three-wire feeds, and not on the neutral, we still find considerable carelessness in the observance of this requirement.

Illustrating the necessity for the above precaution I would point to two complaints recently received.

(a) Woman while wiping off top of range with a damp cloth complained of receiving shocks, although all element switches were "off" at the time.

(b) Woman picking up kettle and with other hand touching range body got shock although all element switches were "off." In this case there would appear to have been some substance accidentally bridging the kettle bottom and the element wire.

Both above cases were fortunately in districts where the neutrals are grounded, hence, the maximum voltage to ground would be limited, but it is evident that with ungrounded neutrals shocks of much greater intensity are possible. A fatal accident due to such a cause would not only be exceedingly regrettable, but would materially check the growing popularity of electric cooking.

May I count on your thorough co-operation in eliminating the above risk?

Chicoutimi Pulp Co. Expanding

The Chicoutimi Pulp Company, P.Q., announces that it has acquired a controlling interest of 11,150 shares in the Saguenay Light & Power Company, which operates an electric light and power system in the town of Chicoutimi and surrounding district. This company owns and controls valuable water grants on the Peribonca River, hydro-electric station on the Chicoutimi River, and two small hydro-electric stations on the Ha! Ha! River, the output of which is sold to the Ha! Ha! Bay Sulphite Company, Limited. This latter company controls through stock ownership La Compagnie du Telephone Saguenay-Quebec, operating over 1,000 miles of telephone lines in the vicinity of Chicoutimi and Lake St. John, and connecting with the telephone companies into the city of Quebec. It also controls through stock ownership Le Credit Municipal Canadien, operating a small electric light and power company, located at Rimouski, Province of Quebec.

National Contractors Association Convention

The eighteenth annual convention of the National Association of Electrical Contractors and Dealers will be held in Cleveland July 15-20, with headquarters at the Hollenden Hotel. The executive committee meetings will occupy Monday and Tuesday, and the convention proper will be opened at 10 o'clock, Wednesday, July 17. An interesting item on Wednesday's program will be a paper by L. K. Comstock, of New York, on "Scientific System of Wage Adjustment." On Thursday, J. R. Strong, past-president of the Association, will speak on "Organization," and W. L. Goodwin will describe the Goodwin Plan. On Friday, G. M. Sanborn, of Indianapolis, will read a paper on "How to Open a Retail Store." Another interesting paper will be "How an Electrical Contractor Can Become a Successful Retailer."

Montreal Employees Get Increase

After prolonged negotiations, the Montreal Tramways Company has come to an agreement with its employees as to advances in wages. The representatives of the men asked for a larger increase than is to be given, and as the company put forward a lower schedule, a compromise was agreed upon. The advance will involve an average increase of 20 per cent. of the wages bill of the company, or a total of $600,000. Motormen and conductors obtain increases of from 6 to 9 cents an hour, the new rates being from 31 cents an hour to 37 cents an hour. All other branches are included in the arrangement, including power house, linemen, rolling stock, car barn, construction, and bridges and building departments. The raises here are from 3½ to 13 cents an hour, switchboard operators and assistant engineers being the highest paid employees in the electrical department, with wages of 42 and 42½ cents per hour respectively. The linemen are paid 32½ cents per hour. Ten hours will constitute a day's work, with time and a half to be paid for all time over ten hours.

90 per cent. are granted rate increases.

Mr. Samuel Insull, President of the Commonwealth Edison Company of Chicago, recently said that out of 460 applications made by United States central station companies for increased rates in the year 1917 upward of 400 decisions were given favorable to an increase. Mr. Insull added: "The experience with those of us who have appealed to the properly constituted authorities to deal with the question of our rates gives me every confidence that, if we are diligent in the presentation of our situation to those properly constituted authorities, we are bound to get relief."

B. C. Contractors Association

The B. C. Association of Electrical Contractors and Dealers held their regular monthly meeting at 406 Yorkshire Building, Vancouver, B.C., on the 4th instant. There was a large attendance, the chair being taken by the president, Mr. C. H. E. Williams. The business of the meeting consisted of the appointment of a secretary-treasurer, Captain W. J. Conway, 1575 12th Ave. W., Vancouver, B.C.; and the appointment of a special committee to make arrangements for the next (second) annual meeting, which is to be combined with a picnic to be held at Victoria, B.C., about the middle of August, when, it is hoped, Mr. Elliot of San Francisco will be present to repeat his kindness of last year, by giving the association the benefit of his advice on matters electrical. The president read his report on the California Convention, and was tendered a vote of thanks for his excellent work and report. Mr. Hayward was present as a delegate from the Victoria Association.

Toronto Hydro Seventh Annual Report

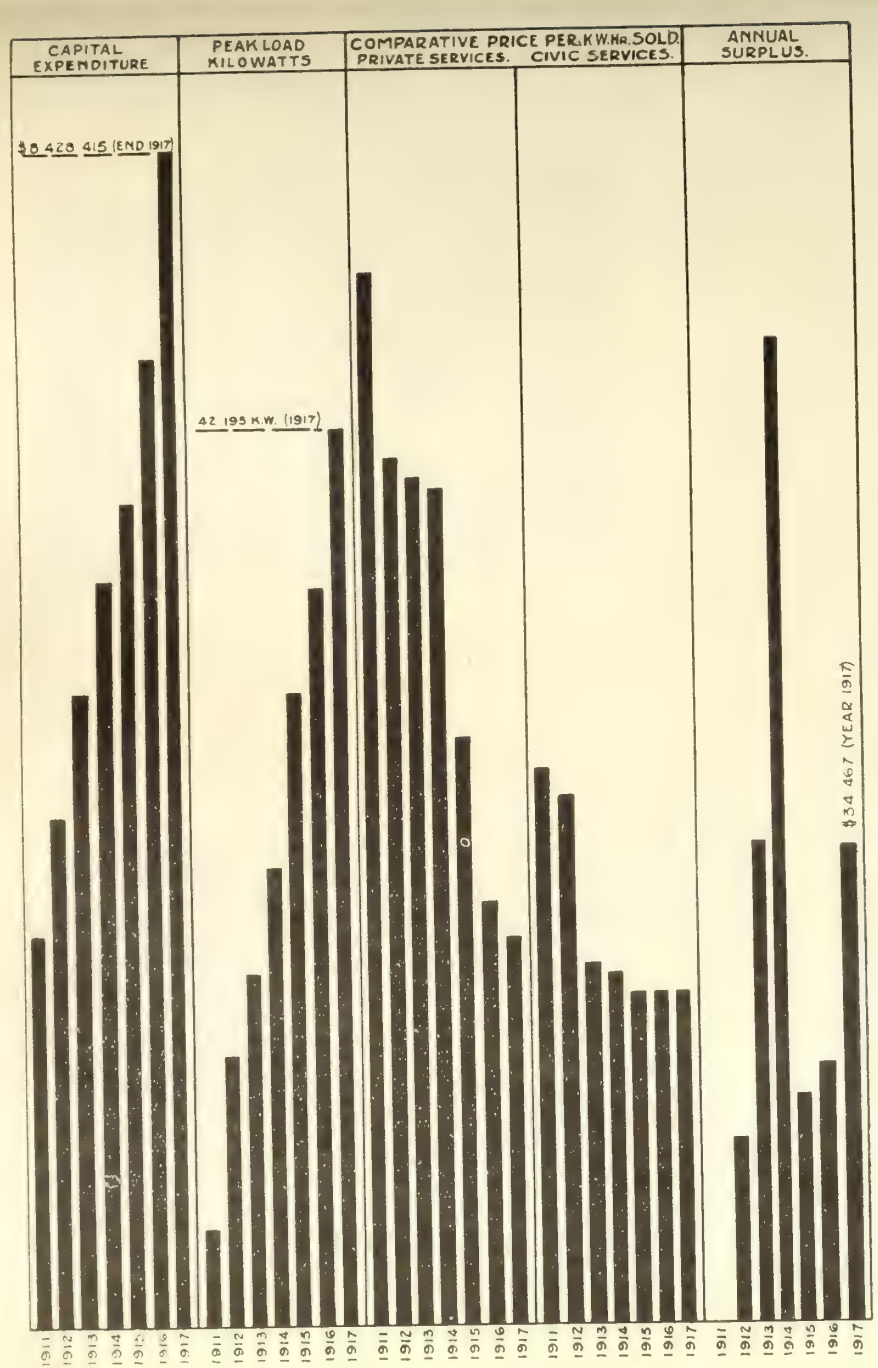
The Toronto Hydro-electric System have issued their seventh annual report covering the year's operations January 1 to December 31, 1917. The gross income for the year amounted to $2,049,383; cost of electric current, including expense of operation, management, repairs and maintenance, $1,294,023. This left surplus income on operating account of $753,360. Interest, depreciation and sinking funds required $720,893, which left a net surplus of $34,467.

The number of meters in use is now 50,461, an increase of 15 per cent. for the year. The connected load is 169,118 h.p., an increase of 20 per cent. The number of kw. hours sold during the year was 171,691,213, an increase of 24 per cent. Rates have been reduced as follows: Residence lighting 9.4 per cent.; commercial lighting 8.1 per cent.; commercial power 10.1 per cent. The total assets of the system now amount to $10,317,531.

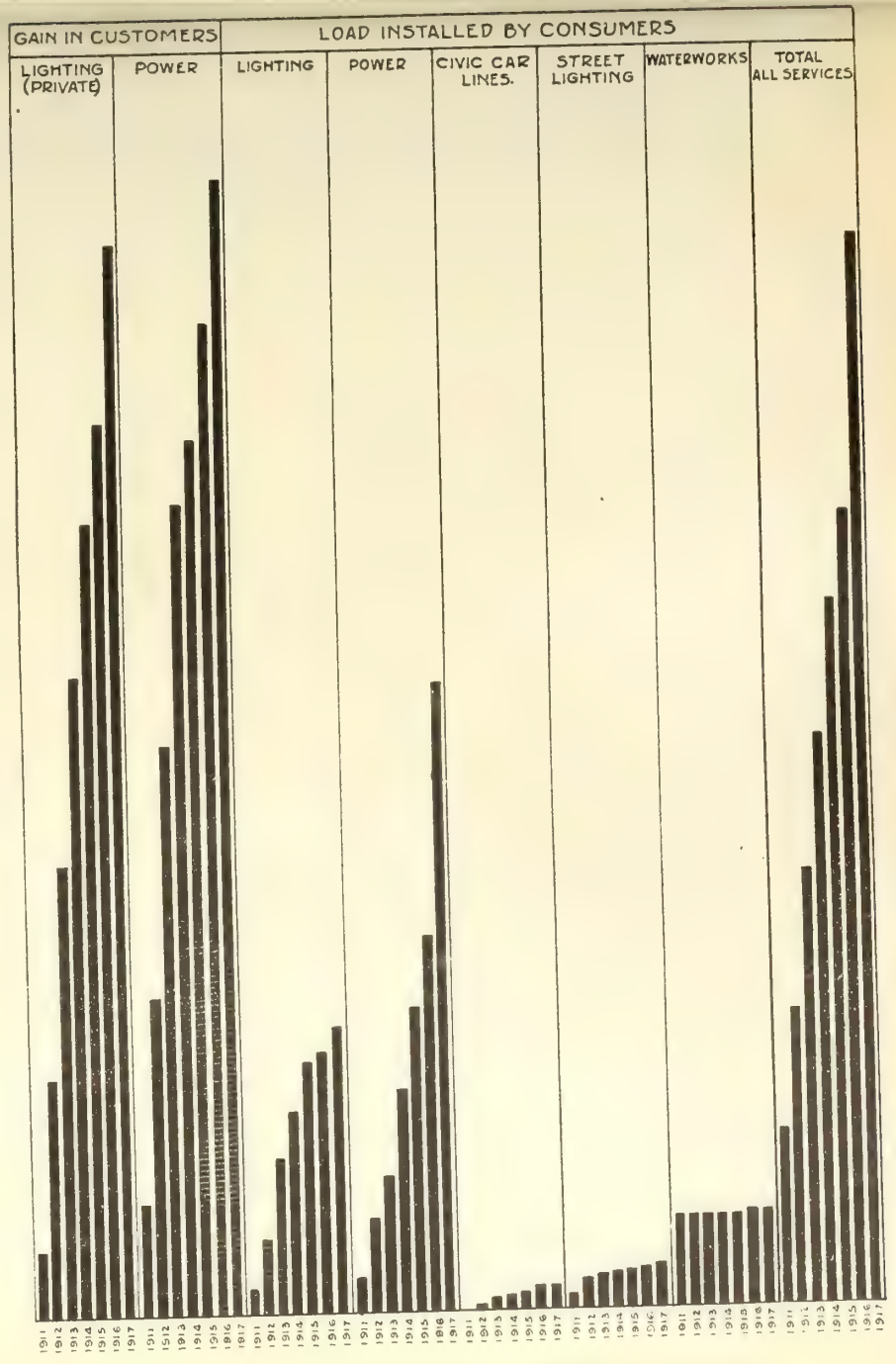
The year's operations may be summarized from the general manager's report as follows: Increased income for the year, $343,200—roughly a gain of 20 per cent. over 1916; increased operating expenses, $66,600—an increase of only 12¼ per cent. Thus the revenue has increased at a considerably more rapid rate than has the cost of operation—and this in spite of a lower revenue per kw. hour sold.

A number of interesting items are mentioned in the general manager's report, such as the difficulties encountered due to power shortage; the inconvenience caused by their head office fire; the extension work necessitated for the supply of power to British Forgings, Limited; the decision to carry the System's insurance in connection with the Workmen's Compensation Act; for this laeter purpose a fund has been set up to which is credited a sum based on the cost of carrying the insurance if placed through an insurance company. The report also notes that a special sub-department has been started to deal with accident prevention along educational lines; the installation of synchronous apparatus for the correction of the system's power factor; the prosperity of the appliance department, in which the number of articles sold was in the neighborhood of 20,000, and, finally, the honor roll on which it is noted that during the year additional casualties include 2 killed in action or missing and 7 wounded. The commissioners have continued the grant, as before, to the dependants of the employees with the colors, the cost being debited to the year's operations.

Dr. S. S. Wheeler, President of the Crocker-Wheeler Company, stated at the Atlantic City convention that there are now forty blind men in the employ of his company, making good wages winding coils.



Toronto Hydro-electric System—Capital Expenditure, Peak Load, Comparative Rates and Surplus, year by year.



Toronto Hydro-electric System—Growth of business year by year, separate services.

Association of Municipal Electrical Engineers

Holds First Annual Convention at Niagara Falls—Inspection of Ontario Hydro Commission's 300,000 h. p. Chippawa Development

The first annual convention of the Association of Municipal Electrical Engineers of the Province of Ontario was held at Niagara Falls on Friday and Saturday, June 14-15, Mr. E. V. Buchanan, general manager of the London Public Utilities Commission, presiding. In his opening adress Mr. Buchanan remarked on the fitness of the location for the first convention of the Association of Municipal Electrical Engineers—the centre of Hydro-electric power for the province and where so great a reserve of water-power still awaits development. He did not think any group of electrical men on the globe had a greater heritage than we in Ontario, and in this connection he coupled the name of Sir Adam Beck, whose recognized ability, tireless as it was keen, was chiefly responsible for the development of the whole great project. The President regretted that a number of the municipalities had not yet joined the Association and urged that each member should become a recruit in explaining to these municipalities the advantages to be gained through membership.

Brief reports were presented by the secretary, treasurer and the officers of the standing committees. These indicated that the Association was in a most healthy condition, both as regards members and finances. The various standing committees, for the most part, had little to report on account of the short interval that had elapsed between their election to office and the present convention.

Amendments to Constitution.

One of the first amendments to come up for discussion was that regarding the advisability of including manufacturers as members of the Association. A keen discussion by Messrs. Yates, Shearer, Ireland, Kribbs, Lines, Leacock, Phelps, Chase and others, resulted in the adoption of a motion to the effect that an annual fee of $10.00 be charged and that manufacturers should consider themselves free to send as many representatives as they wished. The discussion rather tended to favor a grading of the fee, but it was felt that this could be left for further consideration at a later date.

Another amendment to the constitution related to the expenses of the members of the executive committee to the various meetings in Toronto and it was finally decided that it would be fair that delegates should charge their railway expenses to the Association and their other expenses to their municipalities on the supposition that the members would be able to combine with the business of the Association a certain amount of business for their own municipalities.

Another important amendment dealt with the representation of the various municipalities on the executive committee of the Association, the province being divided into sections, each electing a member.

The President then introduced Mr. H. F. Strickland, who read a paper on "The Evolution of Electrical Inspection in Ontario."

Discussion on Mr. Strickland's Paper.

There was a considerable amount of discussion and criticism of the rules and regulations of the Commission, many of the objections doubtless being well taken. It was pointed out by Mr. Strickland, however, that the Fire Underwriters' Association absolutely controls the situation and they are guided by the National Code. Mr. Strickland further emphasized the fact that this National Code is the result of most careful deliberation of the various electrical organizations of the United States, and if they felt that these regulations were in the best interests of the electrical industry at large we could probably not do better than follow in their footsteps. Mr. Scott asked Mr. Strickland to give the association some ideas on the evolution of electrical rules, and Mr. Strickland, at some length, described the various phases of discussion and consideration through which these rules must pass before they become law.

As the outcome of Mr. Strickland's paper, and the dis-



President E. V. Buchanan, London.



Secretary S. R. A. Clement, Toronto.

cussion which followed, a motion was carried requesting the Rules and Regulations Committee of the Hydro-electric Power Commission to allow a representative of the Association to be added to that Committee. Mr. Scott, who introduced the suggestion, emphasized the fact that the men in the field were more closely in touch with the requirements as regards rules and regulations than the Hydro men themselves could possibly be and, for this reason, they should have a representative on the Committee. Mr. Strickland favored the suggestion. A representative will be named by the chairman of the Rules and Regulations Committee of the Association.

Enquiry was made as to the outcome of the resolution previously submitted to the Hydro Commission asking that the name of the Inspection department be changed so as to omit the word "Hydro." As the secretary reported that no decision had ever been given on this point he was instructed to write the Commission again to urge that action be taken immediately.

"Factory Lighting"

An interesting, illustrated paper on "Factory Lighting" was presented by Mr. H. H. Madgsick, of the Engineering Department of the National Lamp Works of the General Electric Company. A hearty vote of thanks to Mr. Madgsick was moved by Mr. Kribbs.

On Friday evening the Association supper was held in the restaurant of the Administration Building of the Queen Victoria Park Commissioners, at which some 160 delegates were present. The chairman dispensed with unnecessary toasts and introduced Mr. Fred W. Field, H. M. Trade Commissioner, of Toronto, who spoke on "Overseas Trade." Mr. Field explained that the relationship between the colonies and the Mother Country was being more closely cemented as the various units of the Empire realized one another's resources, and in this respect Canada had come in for a great deal of valuable publicity. At the present time a very keen interest was taken by the Mother Country in Canadian trade which after the war would doubtless develop, if properly handled, to tremendous proportions. With this end in view the number of trade commissioners had been increased, Canada now having four, Mr. Field himself representing the Province of Ontario.

Mr. Geo. C. Rough, president of the Packard Electric Company, followed with an intensely interesting address on his experiences during "Thirty Years as an Electrical Salesman." Mr. Rough deprecated the idea that salesmen are born and not made. Of course a good salesman is all the better for having natural tact and ability to size up the customer at first glance, but success in selling is very largely a matter of hard work, long hours, and the faculty of arousing the interest of the customer through an appeal to one or other of his personal hobbies. A description of the visit of Joe Fissette to an electrical convention in Quebec City was the climax of a thoroughly enjoyable half-hour.

On Saturday morning Mr. J. F. S. Madden, sales engineer of the Hydro-electric Power Commission, delivered an address on "Sales Service." Mr. Madden discussed a number of interesting points which resulted in considerable discussion. One of the points about which considerable interest centered was that of a central purchasing department and, in connection with it, the action of manufacturers combining together for the purpose of securing better prices. Mr. Madden pointed out that in the United States the power of manufacturers to fix prices will probably soon be legalized and the tendency appears to be in the same direction in this country. A number of the delegates considered that a centralized purchasing department was not without its disadvantages. The larger municipalities did not stand to profit as much as did the smaller. The chief objection to such an arrangement, however, seemed to be that by placing a very large order with one manufacturer, competitors in this particular line were for the time being greatly inconvenienced and, so, unable to keep their organizations together. At the same time the one manufacturer who had obtained the order would be over-driven and probably unable to make delivery. If the order were given to another manufacturer the next time this condition would simply be reversed. In Mr. Madden's opinion it was largely this practice that had driven the manufacturers to combine for self-defence. Unless it were possible for a central purchasing committee to distribute the orders fairly evenly it appeared to be the consensus of opinion that municipalities had better be left to do their own purchasing. Delegates who participated in the discussion included the President, Messrs. Yates, Sifton, Coleman, Kribbs, Phelps, Shearer, Fisk and Chase.

Synchronous Motors.

Mr. M. J. McHenry, manager of the Hydro-electric System, Walkerville, read a paper on "Applications of Synchronous Motors." Mr. Leé, of the Toronto Hydro System, discussed Mr. McHenry's paper at some length as did also Messrs. Lines, Ireland, Sifton, Yates, Kribbs, Heeg and Scott. The opinion was generally expressed that the customer should be held responsible to a greater degree for the correction of power-factor. Mr. Lee thought a little education would go a long way in this direction. It was pointed out that many customers are now charged on a power factor basis—that is, they are penalized if their power factor is poor, or bonused if it is particularly good. This seems to be the fairest method of adjustment for everyone concerned and it has quite frequently been found possible to correct the trouble without resorting to the installation of corrective apparatus.

Resuscitation.

Mr. Wills Maclachlan, safety engineer, Toronto, gave a demonstration of resuscitation on two hydro linemen. Mr. Maclachlan has practically organized the whole province in resuscitation work and accident prevention, both for the Hydro-electric Power Commission and for the private companies, and a noticeable decrease in accidents is reported. Evidence of his good work is shown on every hand.

The Saturday session concluded with a brief description of the Chippawa development of the Ontario Commission by Mr. H. G. Acres, chief hydraulic engineer. Mr. Acres outlined the various schemes that had been considered, explaining the advantages of the route finally adopted. Following Mr. Acres' discussion the delegates were driven by motor over the twelve-mile route and given a chance to observe actual operations. A brief description of this development work appears on another page.

Municipal Delegates

Oswald H. Scott, Belleville; G. E. Chase, Bowmanville; Geo. Ostrander, John Spiers, Brampton; W. P. Catton, Andrew McFarland, Brantford; Royal Quick, Brighton; W. S. Russell, Campbellford; J. E. Comfoot, Cannington; J. G. Jackson, Chas. E. Clements (Mayor), Chatham; H. B. Chant, Clinton; J. E. Skidmore, Cobourg; E. J. Stapleton, W. B. H. Patton (Mayor), S. Burnside, Collingwood; Charles Eberlee, Dresden; Geo. E. Whiton, Dundas; R. Elliott, Galt; V. F. Hunt, Gravenhurst; John J. Heeg, M. W. Wheeler, Guelph; E. I. Sifton, W. H. Childs, Hamilton; M. E. Jardine, W. D. Scott, Hespeler; H. G. Hall, Ingersoll; S. A. Saylor, Kenora; V. S. McIntyre, Geo. Lippert, Kitchener; E. J. Hartrick, Kingston; C. J. DeBatts, Leamington; W. E. Reesor, Lindsay; E. V. Buchanan, A. C. Hunt, G. W. Blay, London; W. R. Savigny, James Rennie, Merritton; J. S. Milliken, Midland; A. C. Clemens, J. C. Grosch, Milverton; Thos. E. Bell, Geo

Stevens, Meaco; Charles A. Walters, Napanee; Geo. Morley, New Hamburg; J. W. Cook, New Toronto; J. W. Bayliss, C. L. Foster, Niagara Falls; W. Daykin, Norwich; A. T. Hicks, Oshawa; J. R. McLauden, A. F. Armstrong, Owen Sound; H. O. Fisk, Peterboro; G. W. Currie, Petrolia; V. B. Coleman, Port Hope; C. S. MacKenzie, Preston; J. E. B. Phelps, Sarnia; H. F. Shearer, Geo. B. Frost, Smith's Falls; P. B. Yates, F. M. Sewos, St. Catharines; E. A. Burgess, F. E. Welker, I. B. Rutsacher, St. Jacobs; E. H. Campbell, J. J. Roberts, St. Thomas; R. H. Myers, Stratford; E. R. Smithairn, Strathroy; J. E. Techoe, Tilsonburg; R. H. Martindale, Sudbury; H. H. Couzens, E. M. Ashworth, R. G. Lee, W. C. Burch, C. E. Schwenger, A. W. J. Stewart, J. B. Kitchen, C. W. Fatt, Wm. F. Kelly, Toronto; W. J. McHenry, Walkerville; J. R. Forbes, T. C. Savage, Waterword; Geo. Grosz, Waterloo; H. E. Timmerman, Welland; A. G. Pierson, F. G. Cousins, Weston; O. M. Perry, Windsor; W. J. McIntyre, Whitby; J. G. Archibald, Woodstock.

O.M.E.A. Delegates—W. K. Sanderson (St. Thomas), W. Ellis (Hamilton).

Associates—F. A. Gaby, J. S. Parker, S. L. Eisenhoffer, Gordon Kribbs, G. F. Drewry, G. J. Mickler, R. M. Bond, E. R. Lawler, A. G. Lang, J. N. Wilson, J. H. Caster, J. J. Jeffery, L. G. Ireland, S. R. A. Clement, R. C. McCollum, H. J. Surtees, F. T. Stocking, J. F. S. Madden, W. M. Bostwick, Wills Maclachlan, W. H. Mulligan, K. R. McClellan, E. T. Brandon, B. O. Salter, H. C. Don Carlos, H. F. Strickland, W. P. Dobson, Hydro-electric Power Commission of Ontario.

Visitors—J. A. Shand, J. F. Hill, W. H. Christie, H. A. Burson, Canadian Crocker Wheeler Co.; J. W. Taylor, A. C. Johnston, W. M. Andrew, Canadian Westinghouse Co.; W. R. Greenshields, Canada Wire & Cable Co.; H. E. Hunter, F. A. Mahoney, C. H. Beavis, A. S. McCordick, B. F. Selby, Wm. A. Bucke, A. G. Cooper, W. G. Young, Canadian General Electric Co.; S. L. B. Lines, Chamberlain & Hookham Meter Co.; W. S. Ewens, H. J. Hammond, Northern Electric Co.; R. H. Starr. Geo. D. Leacock, Moloney Electric Co.; Geo. C. Rough, Packard Electric Co.; C. C. Bothwell, Laco-Phillips Company; Fred W. Field, H. M. Trade Commissioner; H. G. Acres, Hydraulic Engineer, H. E. P. Co.; S. L. Weber, St. Jacobs; S. Stroud, Hamilton; C. N. Farrow, J. J. O'Hearn, Toronto; L. M. Bradley, St. Thomas; K. M. Sorrich, Chatham; C. V. Edmonds, V. K. Stalford, Geo. W. Howse, A. T. Smith, wiring inspectors, H. E. P. Co.

The Evolution of Electrical Inspection in Ontario

By Mr. H. F. Strickland

Electrical Inspection in Ontario dates back approximately to the year 1892, as near as I can recollect, a year or two after what was then known as the Toronto Incandescent Electric Light Co., was established. At that time I was connected with the old Incandescent Company under Senator Frederic Nicholls and had a good deal to do with the obtaining of contracts for the installation of wiring and motors in Toronto, the estimating on these jobs and looking after this part of the work generally.

Electrical inspection at this time was introduced by the Fire Underwriters as a precautionary measure and what inspection there was then was in charge of Mr. A. Bruce Smith, then Superintendent of Construction for the G.N.W. Telegraph Co., and now Manager of Telegraphs for the Grand Trunk Pacific Railway. The peculiar part of the situation in those days was that inspectors carefully and in due form certified to what we now would just as carefully condemn. This was not, of course, through any fault of the inspectors. In those days I can distinctly remember the lay-out of wiring jobs and often think how different they were from the present day and more often what would occur in Ontario to-day if wiring was still performed in the same manner. No doubt you have all used the argument and had it used in turn upon you, at least I know we have, that because a wiring installation as performed twenty years ago did not always burn the building down the first night it was connected up, that it is just as good as the work done to-day and that there were not more fires then than there are now. This statement may sound perfectly logical to anyone who wants to believe it without knowing the facts.

In those days I knew almost every installation which was connected up in the City of Toronto, and practically every wiring job which was being done in the same city. Toronto was at that time a city of considerable proportion and population and it was not very long after that when there was a very large building boom. Nevertheless, when there were three or four wiring jobs being done at the same time, things were what we might say "humping."

In the year 1892 and the two or three years following, wiring was installed in a variety of ways, which to say the least would be startling and interesting to behold at the present day. I can at the moment clearly see, with my mind's eye, the wiring in a building in Toronto which has since been pulled out which consisted of rubber-covered wire threaded through the joists with gimlet holes and then tacked on to the brick ways between the strapping with pieces of tape and a nail, much in the same way as a Virginia Creeper would be trained up the side of a house. When these wires, or electric creepers, were carefully tacked on the walls they were then covered in with fresh wet plaster. These circuits were ostensibly protected by wooden cutouts dipped in paraffine with open fuse wire and then mounted in wooden pockets in the walls, strictly without asbestos.

The chief form of protection and general finish in most wiring was a good daubing up with P.&B. compound, which was commonly known as "stink." So long as a wireman could daub a lot of P.&B., on the cutout box and generally daub everything up that did not look right electrically, it was generally considered a very good job.

The service equipment consisted generally of a piece of board nailed up some place handy; it did not make much difference whether it was in a clothes-closet, basement or attic. The service wires came in from outside through a couple of gimlet holes in the board and after being wrapped with tape they generally ran directly to the branch cutouts after passing through an Edison electrolytic meter. No doubt, theoretically this meter was the most accurate registering meter which was ever produced, but no doubt before the customer received his bill there were several inaccuracies which might creep in, such as the weighing of the elements and the recording of same in the books, and ultimately the computing of it in dollars and cents. Of course, we know that no one in the electrical business would think of increasing a customer's bill, but I merely point out what an easy matter it would be with meters of this description for someone to read these meters as high or low as was considered advisable or necessary.

When this meter was installed on the board, the meter board such as it was was likewise well daubed up with "stink" and the service was completed in due form.

The salvation of a great deal of the wiring in those days was undoubtedly owing to the high-class of wire used.

Rubber-covered wire was very superior, and I may say vastly superior, to the wire which has been used in Ontario up to the last year or two, in fact rubber-covered wire became a standing joke and I have heard it stated on good authority that one manufacturer made the broad statement that he was making rubber-compound for wire without using any rubber. The new Code rubber-covered wire which is required to-day, is however, very much superior to that which has been used during the past ten or fifteen years, but I doubt very much whether it is as good as the rubber-covered wire which appeared in the early part of 1900.

It does not require a very great amount of abstruse calculation to answer the question touched upon a few moments ago as to why there were no more fires at that time than there are to-day with all our modern improvements; one has only to consider the ratio as between the amount of current used then and at the present time, to answer this question. In those days the large percentage of electric light, especially in the large cities, was direct current, and the question of break-down between high and low tension and the grounding of secondary did not enter very largely into the question at all, until some few years later and where there was one building wired up in those days there are many hundreds to-day.

It now seems an opportune time to pass some comments on the Electrical Inspection of the past to make it very plain that I do not wish to reflect in any way upon the past inspection or anyone connected with it. One might as well compare the efficiency of a soldier with the old flintlock musket and the marksmanship of a crack shot armed with a modern Enfield rifle. The present inspector is vested with Rules and Regulations which are the outcome of past experience, and now enjoys a legal status which did not exist in those days.

The Fire Underwriters, who inspired the first production of an electrical code, did not do so out of love for their fellow men but as a protection to themeslevs and no one should blame them for having so done. It seems to me that when an aggregation of companies is expected to pay for fire losses that they have a right to know what they are paying for. The motive of the Underwriters' Regulations has always been the protection of buildings against fire, and they did not pretend to make regulations for the protection of life, although there are a certain number of rules in the National Code which have been adopted for that purpose, but only recently.

A few years ago, practically the only inspection which was carried on in the North American Continent was that of the Underwriters' Inspection Bureau in the different cities and towns of Canada and the United States. This has been followed in recent years by some of the cities, where civic ordinances were passed causing Electrical Inspection to become mandatory.

In most cases the Underwriters objected to anyone doing electrical inspection but themesleves. Possibly they are to be excused for this attitude, owing to the fact that they are paying for the losses. I know that at the present time the Fire Underwriters frequently hand me some comments to the effect that our electrical inspection is far from being as effective as it should be, and it was only during the last month that I was told by the chief official of the Underwriters' Association that we are unable to carry this inspection as far as we should and in many respects it is a failure. This, of course, was said to me in an apparently friendly spirit and no doubt this body sincerely believes this to be true.

This Would Satisfy the Underwriters.

There is only one system of Electrical Inspection which will ever satisfy the Underwriters (and this is said with the best feeling and with all deference to them) and that is a system of inspection which will not allow any electrical work to be installed in buildings at all, nor any electric current to be supplied thereto and the only electric light which should be permitted in buildings to be in the form of portable flashlights. Such a condition would be ideal for the Fire Underwriters as there would be positively no fire losses from electrical causes.

Commenting further on the attitude of the Underwriters towards this inspection, I think the chief trouble is that they have not really seriouly analyzed the work of the Inspection Department or made a fair comparison as between what is being done now and what was done in the old days. Having been Chief Electrical Inspector for the Canadian Fire Underwriters Association for a period of five years I think that I can justly claim to know as much about the subject as anyone else. As a matter of fact, I was the first inspector employed by the Underwriters who was called upon to devote his whole time to organizing and enlarging the whole system.

When I took over Electrical Inspection in Toronto some twelve years or more ago, the entire work was being carried on by Mr. Smith, who was Superintendent of Construction for the G.N.W. Telegraph Co. No one who knows Mr. Smith would say anything about him except what would be favorable from every point of view. Mr. A. B. Smith enjoyed the respect and admiration of everyone who knew him and undoubtedly if he had the opportunities which I have had and had devoted his whole time to Electrical Inspection he would have made a great success of it and my effort would have looked very small in comparison. At that period, however, Mr. Smith's time was very largely devoted to the work of the Telegraph Company and as there was no law requiring inspection, no one was obliged to have work inspected. Such conditions tended to produce chaos. For instance, no wireman could tell whether to figure on a good job or a bad one. The general result with the wiring was that a good contractor wished to do a good job and only did so when he had the work at his own price, or after having ascertained who was competing with him. If only two or three good wiremen were asked to figure on the job there was some chance of getting a fairly good job done, but if two or three cheap men had a hand in the pie, chances were that the job was a poor one with no guarantee that it ever was inspected, in fact it often was not. As soon as it was ready (and often before) the electric light company would issue a service certificate.

I can remember in the early days of the Toronto Hydro where rows of houses were being built, it was often a race between the Toronto Electric Light Co., and the Hydro for service and I have seen one or the other of these supply authorities install services in a whole row of houses before they were lathed and plastered, and put the meters in and turn on the current. This was a very undesirable state of affairs, and it was a wonder that there were not a number of people killed or a number of fires resulting from this mad rush for current regardless of the safety of others.

I distinctly remember one case where a couple of Italians were digging in the cellar of a house when one of them happened to touch the main switch. He got a nasty shock and out of retaliation he took his spade and smashed the meter and everything else to pieces.

Companies Mixed Their Meters.

Things became worse and worse and I have known cases where the companies forgot whose meters were whose. I remember another instance where a Hydro meter was in a house and was connected up to the Toronto Electric Light Co's. service wires, so that one company was deriving a revenue from the other company's wires through their own meter. Jumpers around meters to shut them out altogether

was also a very popular past time in those days and no one [illegible] deprived of service owing to a blown fuse so long as there was a wire nail or a pant button not working. But this was not all. There were a few legitimate wiring contractors in Toronto and vicinity and a score or more of people doing wiring (with the accent on the **doing**); and not only doing the wiring but also the people for whom they were doing it. You can judge to what an extent this was carried when I tell you that I know of a row of houses in which the wiring was let to some itinerant contractor and the builders, after having paid this contractor about 85 per cent. of his total contract (of course without inspection) suddenly discovered that there were no wires in the houses at all, that the contractor had merely wired up to the outlets and succeeded in some way in having it lathed over before his little joke was discovered. In other words, the woods were full of carpet-bag contractors, boys and other amateurs who considered themselves quite competent to wire up anything as they felt disposed.

I have in this paper so far alluded chiefly to the conditions in Toronto. Ths is owing to the fact that Electrical Inspection in Ontario was very largely a matter of Toronto. There was a little inspection done on the side, consisting of the local managers of the G.N.W. Telegraph Co., in Hamilton, Brantford, and Kingston, and only after I took over the Underwriters' inspection there was an inspector appointed in the City of Ottawa.

To make a long story short and to make a fair comparison of the conditions which exist to-day as against those existing in the days of Underwriters' inspection, one has only to state that to-day in the Province of Ontario there is not a square inch of territory left uncovered. Electrical inspectors are now duly appointed and have been carrying on their work in the different districts extending from Windsor to Ottawa and from the very southernmost part of the Niagara Peninsula right up to Kenora, Sudbury and Timmins on the north.

Touching on Electrical Inspection as it is to-day one of the most important requirements, in fact I believe that it is the very backbone of the whole inspection system, is the permit, which is required before the work may be performed. If the law merely called for an application for inspection on all work as performed or that had been performed, it would not begin to be as effective as the permit. Any itinerant or other doubtful wireman could always make the excuse that he intended having the work inspected. This excuse could be raised a day, a week or if necessary a year after the work was done, but the permit to perform the work clinches the argument at the start and I believe it has been the means of weeding out more doubtful and inferior wiremen than any step which has been taken, and I am glad to say that the Commission has supported us in enforcing this requirement.

Activities of the Inspection Department.

The energy of the Inspection Department has not been solely devoted to the inspection of new work either, as the following figures will show: From June 1st, 1917, to May 11th, 1918, the sum of $241,936.46 has been expended by electric light consumres, owners of buildings and others responsible, in removing dangerous and doubtful wiring and these figures would have been much greater were it not for the abnormal price of labor and material.

In addition to this we have annual contracts with 455 manufacturers and other concerns which entitle these parties to a monthly inspection of their works. These monthly inspections have proved so satisfactory that the larger proportion of them were renewed this year and such as dropped out have been replaced with new ones. I have not heard of any inspection department on this Continent which carries on a system precisely the same as this, nor do I know of any department where the permit system is as strictly enforced or as generally uniform as it is in this province. There are a few departments in the States where they have local by-laws, each with its peculiar differences in law and interpretation but I do not know of any district as vast as Ontario which is under one administrative head and which is under the same uniformity of law and interpretation as this.

Nor are we behind the times in our methods of construction. In many up-to-date inspection departments in Canada and the States the open switch and service equipment is still accepted as o.k. I have seen electric services in many cities in the States and Canada and do not know of anything which is more up-to-date, more finished looking, safer or modern than our iron-clad service equipment, especially when hitched up to an A-1 conduit installation.

At this juncture I would hint at an innovation which is likely to materialize in the very near future, in fact before this paper is read it may have become a reality, and that is a new method which has been submitted to the Commission and approved, covering the installation of electric fixtures. This system does away at one sweep with all the objections to the hanging of and wiring to the fixtures at the outlets. Of all the dirty jobs in the wiring of a house, the hanging of a fixture is the meanest to be found. Anyone familiar with house wiring knows that under the fixture canopy is the weakest spot in the job. Often we find here a mixture of crowfeet, joints in wires and screw nails, all jumbled up in a heap right at a hole in the ceiling where shavings and other inflammable material accumulate and where a fire can be beautifully encouraged with the draught which is so common between joists in any building.

Result of a Transformer Breakdown.

I remember quite clearly an incident in a large city in Ontario where a transformer broke down one afternoon and something like twenty-two fires developed in a few city blocks supplied from this large transformer.

I examined a number of these installations and in nearly every case the fire broke out under the fixture canopy. The new method referred to will enable a school child to install the ordinary electric fixtures in a house with a twist of the wrist. The brackets can be put in as easily as an electric iron can be attached to a receptacle and the only difference with the pendants being the assistance of a step ladder, and fixtures can be removed just as easily and quickly. In order to make this method of installing fixtures possible and to facilitate the adoption of same, the Rules and Regulations of the Commission will be amended to call for outlet boxes on all outlets in connection with knob and tube work, now only a recommendation. The added cost of an outlet box is a small matter and the first installation of fixtures on a job will more than pay the entire cost and it will be a gain each time fixtures are put in and taken down.

The enforcing of electrical inspection sometimes appears different to the inspected then it does to the inspector and we meet with all kinds of people and all kinds of arguments. In all fairness to the Electrical Inspection Department it must be conceded that in order to carry on a system of inspection it is first of all necessary to have a set of Regulations and by the very nature of electric construction it is demonstrated that they must contain a great variety of detail and figures. There are times when the enforcing of a Regulation may appear arbitrary. On the other hand, a little laxity may appear to the other fellow as rank favoritism. This depends entirely upon the attitude of the parties interested and whether they are the inspected or the inspector.

We have endeavored in every possible way in enforcing

these rules to keep the new work strictly up to the Rules and Regulations. This seems to be the only way to give ultimate satisfaction and I think I can safely say that the majority of the best wiring contractors and parties interested in Ontario appreciate this fact. By so doing, all contractors and others are placed on a fair basis when estimating on work, and if not now, perhaps sooner or later people will feel that they have some measure of protection when letting contracts for wiring when they call for the production of the inspector's certificate.

Inspectors are Experienced Wiremen.

Neither the writer nor any of the inspectors on this staff claim to be a finality on everything electrical,—far from it. I do claim, however, that every man holding a position as electrical inspector on the Commission's staff has been a well-trained journeymen wireman before he commenced his training as an inspector, in fact the large majority of these inspectors served many years in the electric wiring trade with the largest and best-known electric concerns in Canada and the States, and not only were they familiar with the trade itself but were well posted on the tricks of the trade.

There is an old saying that "it takes a thief to catch a thief" and the varied tricks of shady wiremen and contractors are quickly detected. Not only must inspectors keep abreast of the wiring trade and the development of this art but they must keep thoroughly familiar with every fitting which is used, just why it is used and whether it is real or imitation, and incidentally keep track of the doings and sayings of all the different wiremen and their peculiarities.

We are frequently confronted with electrical installations which are almost in accordance with the Rules. This is a very distressing condition because if one person is permitted to get away with work that is almost right, the next contractor is prone to take advantage of it, and so on, all down the line and eventually the rule which has been almost broken will become very much dislocated and openly violated. in the long run.

It would take a great deal of time and space to intelligently record and put into interesting reading form all the idiosyncrasies of the Electrical Inspection business. There are many things we would like to speak of and some things for obvious reasons we cannot, and in touching on these questions of the tricks of the trade we do not like to pass over the point without speaking in no uncertain terms of appreciation of the co-operation we receive from regular bona fide contractors and their affiliated organizations.

We have tried in every way to improve the wiring conditions and bring electrical construction and inspection up to a high and sane standard in this province and we hope to continue to do so, as long as we receive the support which which we now do from the Commission and the co-operation which is enjoyed from the contractors and others.

With the foregoing remarks I will bring this paper to a close. If my subject has proved at all interesting and there is any discussion to follow I would be glad to hear any suggestions or questions which may arise and in concluding I can only say that Rome was not built in a day and I think I can fairly claim that our efforts in developing this inspection work in the Province have met with at least some measure of success and that no stone will be left unturned to further improve conditions. All I ask is that hasty judgment or destructive criticism be avoided.

The Commercial Application of Synchronous Motors

By Mr. M. J. McHenry

The theory of the synchronous motor in its application as a power factor corrector, is familiar to every engineer, and is not greatly complicated. It is not the purpose of this paper to discuss this theory or to call attention to the most approved methods of design calculation. An attempt will be made, however, to point out the principal characteristics of this type of apparatus which make it applicable to certain classes of service, and further to discuss the industrial use of these motors in relation to the central station and its customers. A few remarks will also be included on the selection of the proper motor for different classes of load.

The discussion of the characteristics of synchronous motors can probably best be accomplished by comparison with those of the well known polyphase induction motor. Almost everyone to-day, is more or less familiar with the induction motor and its operation, since this type of motor has been almost universally applied wherever electric power supply is available. In considering the industrial application of synchronous motors, such a comparison should be made with reference to the operation of the apparatus. This would call for a comparison covering starting characteristics, ruggedness and durability of the equipment, simplicity of construction, efficiency and freedom from interruption of service.

Synchronous Motor Maintains High Power Factor.

The principal characteristic of the synchronous motor, and the one which gives it a commercial value, is its ability to maintain high power factor and, if necessary, to be used to improve a poor power factor due to other equipment on the system. For any given load, the induction motor operates at a constant power factor which is always lagging—the lighter the load, the greater the lag. The power factor of the synchronous motor, on the other hand, is always within the control of the operator and can be made unity, lagging or leading at will, by manipulation of the field rheostat. This feature is of particular importance to the central station today, especially where there is long distance transmission and heavily loaded lines, or where the feeder regulation is poor. It also becomes of great interest to the customer whose power factor is low and who is, consequently, being penalized by the power company. This ability to correct power factor calls for the use of the synchronous motor commercially, to increase the capacity on transmission lines which are operating under an overload in current due to low power factor, to increase the capacity of transformers similarly overloaded, to raise the power factor of isolated industrial loads and to assist in maintaining the voltage of feeders and transmission lines within proper limits.

The starting characteristics of the synchronous machine do not differ greatly from those of the induction motor, either machine drawing a heavy lagging current from the line if starting under its load. It must be remembered, however, that it is comparatively easy, in certain types of induction motors to so design them that they can come up to full speed with full load, and not cause a severe drain on the system. On the other hand, synchronous motors that can develop as good torque in starting up, are generally of quite special construction. Consequently, it is not possible to apply the synchronous motor to every service that can be taken care of by the induction motor. As the starting torque of the synchronous motor is usually obtained by means of amortisseur windings, similar to the squirrel cage winding in the rotor of an induction motor, it is possible to vary the

torque by modifying this winding. Theoretically, this is a practical proposition, but for various loads, it is prohibited by the commercial cost of the design required. It is of interest to note that widely different characteristics can be obtained by the use of different materials and methods of design in the amortisseur windings of a synchronous motor without serious detriment to the efficiency of the motor, since it always runs in synchronism under load. On the other hand, the induction motor always has a slip with consequent losses in the rotor winding, which losses are increased with an increase of the resistance in the winding. The starting apparatus required for both types of motors, is somewhat similar, but there is the additional complication, in the case of the synchronous motor, introduced by the d.c. field with its special exciter.

Simplicity an Advantage of the Induction Motor.

From a mechanical view point, there is no question but that the induction motor, with its absence of sliding contacts and its simply constructed rotor, lends itself to more severe service than the synchronous motor with its more complicated rotating field and auxiliary exciter. From an electrical standpoint, the induction motor still has its advantage of simplicity, since little auxiliary equipment is required for its operation and little attendance is necessary after it is once started. The synchronous motor, on the other hand, must have a separate d.c. exciter with rheostats, field switches, etc., and good operation depends largely on the degree of field excitation given the motor.

With regard to the possibilities in efficiency, the synchronous motor, in its nature, has the higher efficiency at the higher loads and the induction motor, at the lower loads, this difference being due to the energy required for excitation of the synchronous machine as compared with the rotor losses of the induction motor. In the synchronous motor, due to the larger air gap and the limitations in heat dissipation in the field coils, the excitation at "no load" is relatively high, but this excitation is not increased greatly at "full load." In the induction motor the secondary loses at "no load" are small as compared with those at "full load." In general, however, it is possible to obtain higher efficiencies with synchronous apparatus than with induction motors. As an example —let us compare the efficiencies of two machines of approximately the same size as shown in Fig. 1. This figure gives efficiencies for a sqiurrel cage induction motor of 250 h.p. capacity, 600 r.p.m., 2200 volt, 3 phase, 60 cycle, and also the efficiencies for a synchronous motor of 240 h.p., 600 r.p.m., 2200 volt, 3 phase, 60 cycle. Curve No. 1 gives the efficiencies for the synchronous motor at 100 per cent. power factor; Curve No. 2, for the synchronous motor at 80 per cent. power factor leading; Curve No. 3, the efficiencies for the induction motor, and Curve No. 4, the corresponding power factor for the induction motor. It will be noted that at full load and ¾ load, the efficiency of the synchronous motor exceeds that of the induction motor, while at the lighter loads, the induction motor has the advantage. It must be remembered, however, that at the lighter loads, the synchronous motor has the advantage of maintaining a high power factor, while the induction motor, has a very low power factor, as will be noted from the curve. Furthermore, the induction motor power factor is always exceedingly low compared with that which can be obtained from the synchronous motor. Extremely good efficiencies have been obtained with synchronous motors, the following being those obtained on actual test with a 250 h.p., 3 phase, 60 cycle, 4000 volt, 1200 r.p.m. synchronous motor for direct connection to centrifugal pump.

Full load	95.3%
¾ load	94.8%
½ load	93.4%

The efficiencies to be obtained with a squirrel cage induction motor of the same capacity and rating, would be as follows:

Full load	93 %
¾ load	92½%
½ load	91 %

From an efficiency standpoint, it would appear in general that better results can be obtained with the synchronous motor.

A valuable characteristic of the synchronous motor is the possibility of increasing its excitation in such a manner that the motor is not in danger of breaking down. It is well known that the maximum torque of the synchronous machine can be increased by over excitation. This increase in exciting current can be accomplished by means of a field regulator actuated by automatic relays, or in the case of motor generator sets, by series coils on the motor fields, excited from the d.c. generator armature. The maximum torque of the induction motor on the other hand, is fixed for any one machine, provided the voltage is constant.

It is well known that once a synchronous motor has fallen out of step, the excitation must be reduced or entirely removed in order to get the motor back into synchronism. This is sometimes used as an argument for the induction motor in cases where the line voltage is likely to be interrupted for a short time or drop to such a low value that the motors fall out of step. This argument is questionable, however, as should full voltage come on an induction motor at

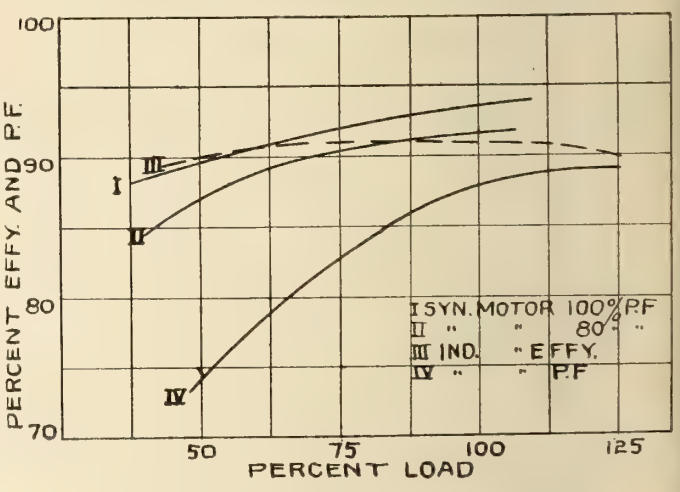


Fig. 1.

rest or running at low speed, the draught of current would be so great as to trip the oil switch and necessitate starting up in the usual manner. It is the general experience in practice, that synchronous motors behave much better under such conditions as partial short circuit, or even the dead short circuit to ground of one phase of the line running to the motor, than induction motors. This is due to the fact that the synchronous motor has its excitation supplied from an outside source and this excitation tends to raise the voltage at its terminals, rather than to reduce it when there is any cause at work on the lines tending to drop the voltage; and furthermore, to the fact that any given strength of field on a motor tends to maintain the ability of a motor to carry load when the potential back of the motor is reduced. On the other hand, in the case of the induction motor, any drop in voltage in the lines leading to the motor must result in a still greater reduction of the voltage at the motor and, consequently, an increased current to carry the load. This in-

creased current, in turn, results in a still further reduction of the supply voltage and consequent dropping out of step.

Before concluding the comparison of these two types of motors, it would be well to consider the question of torque characteristics, Fig. 2. This figure gives the comparative torque characteristics of 250 h.p., 1200 r.p.m., 60 cyc'e, 2200 volt synchronous motor and squirrel cage induction motor. The speed torque curve given for the synchronous motor can be taken as characteristic of this type of motor with squirrel cage winding of average resistance, or that most common in commercial machines. It will be noted that the initial torque of the synchronous motor, exceeds that of the induction motor but that the final or "pull in" torque of the induction motor, is much better than that of the synchronous motor. By using the curves of apparent torque efficiency, we note that for the same input, the torque of the synchronous motor is greater up to about 80 per cent. of speed. It then falls off rapidly, until at 90 per cent. of speed, it is not much more than one-half that of the induction motor.

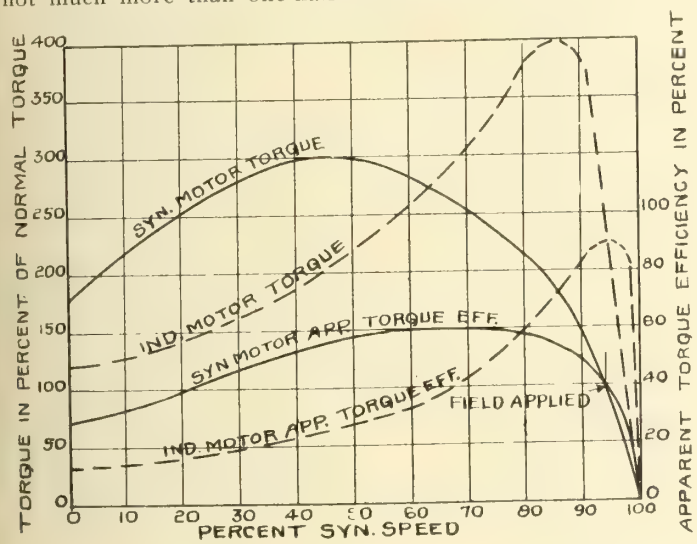


Fig. 2.

Beyond this point the synchronous motor torque is small in comparison with the induction motor until the d.c. field is excited at about 95 per cent. of full speed, when it rises abruptly to full torque.

In view of the foregoing, it is perfectly obvious that either type of motor has advantages which are peculiar to itself, proper consideration of which will enable the engineer to put the right motor in the right place. It is useful to keep in mind the broad distinction that the induction motors are poor and expensive at low speeds while they are exceedingly satisfactory and comparatively cheap at high speeds. Also the greater the capacity of the machine required, the greater the advantage of the synchronous motor in relation to first cost. It is evident that for extremely small applications of power the synchronous apparatus (except in a few isolated cases) has the disadvantage of extremely high first cost and complicated equipment and operation when compared with the induction motor.

It may be stated in general that the customer of a power company has little technical interest in the use of synchronous equipment, since it is more expensive than induction motor equipment, is not readily adapted to extremely small unit installation and is, even with the present design, less rugged and easy to operate. On the other hand, in the larger units, these points are of less significance and industrial application of synchronous motors can be made where relatively large concentrated power applications occur. This may sometimes be supplemented by, but is generally differentiated from, group and individual motor drives in a manufacturing plant. It will, therefore, be found that such applications will be made on large centralized equipment, such as air compressors, refrigerating machines, pumps, motor generator sets, etc., or in certain instances where there is one centralized power supply using mechanical distribution throughout the plant. An example of this latter case is the smaller milling concerns, where all the manufacturing processes are correlated and there is no diversity factor since all machines operate at load when the mill is in commission. This particular case gives an opportunity for the commercial application of synchronous machines more especially so as there is no requirement for frequent starting and stopping which obviously is not advantageous to the synchronous equipment.

From the standpoint of the consumer of power, the motive for the synchronous motor application is found either in a power rate favorable to unity power factor or leading load, in a sharing of the expense of initial installation by the central station company, or in a special rate lower than that for the induction motor service and offered by the central station in consideration of the improvement of distribution conditions which will prove advantageous to the central station company.

Almost all modern systems of charge for electric power are based on the maximum demand in conjunction with the kilowatt-hours usually in the form of a direct charge for power and another direct charge for energy or on a load factor distributed over a period of time. In the latter case the charge comes back to either a recorded demand charge or the rating of the connected equipment. Uusually a metered system of demand seems to be distinctly preferable.

If such a metered demand were based on the kilovolt amperes rather than on the kilowatts, the consumer has a distinct interest in maintaining the power factor as near to unity as possible. In the case where energy is supplied from a hydroelectric plant, over a long distance transmission line, this is the rule and the customer has an incentive to make synchronous installation of usually from ten to thirty per cent. of the annual cost of power.

When operating companies take account of the power factor of the customer's load in making their rates, it is to the customer's benefit to install condenser capacity and thus obtain the benefit of decreased power rates, if, by so doing, the saving in power cost will pay the fixed charges on the capital required, as well as the increased operating charges, due to the installation of such an equipment. Another instance of the value of the correction of the power factor alone would be in case the customer owns the step-down transformers and, due to the natural growth of this plant, the induction motor load has reached the limit of the transformer capacity. The power factor of the average commercial induction motor load is in the neighborhood of 70 per cent. so that by installing a synchronous motor, which in addition to delivering mechanical power would also furnish sufficient leading current to raise the power factor of the whole load, the capacity of the plant could be increased by a considerable amount without increasing the transformer or switching equipment. Under these conditions a synchronous motor of 35 per cent. of the total transformer capacity will deliver an energy load of 20 per cent. of the total capacity and at the same time raise the power factor of the system to 90 per cent.

The efficiency of a generator is affected by the power factor, although this variation is greatly modified by the ratio of the constant to the variable losses in the machine. This is determined by the design of the generator. There will be a difference of 2 to 2½ per cent., however, in the efficiency of a generator operating at normal load and unity power factor, and the same generator operating at the same kv-a. and 0.8 power factor. The excitation required by a genera-

can when operating at 0.8 power factor will be in the neighborhood of 50 per cent greater than that required for the same kv-a. at unity power factor. This rate of increase in excitation does not continue for power factors below 80 per cent.

The effects of varying the power factor on transformers, although smaller in magnitude than the effects on the generator, must be considered since they occur twice, at the step-up and step-down transformers. The losses in a transformer with constant kv-a. output are practically the same for any power factor. However, since the losses are usually small in a well designed transformer, the decrease in the efficiency, due to decreased power factor, will be about 0.4 per cent. with a reduction in power factor to 0.8.

Due to the fact that transformers contain a certain amount of inductance it is readily seen that lagging current will cause an increase in the internal voltage drop of the transformer and thus will affect the regulation, particularly in the case of large transformers which usually have a high reactance. The capacity of a transformer decreases with the power factor in the same manner as in the generating equipment.

The decrease in efficiency, between unity and 0.8 power factor for constant kv.a. in a circuit, which includes generator, transformers and the transmission line, assuming average values, will be approximately as follows:

Generator	2.0 per cent.
Transformers...	0.8 per cent.
Transmission Lines	2.2 per cent.

This gives a total of 5.0 per cent. decrease in efficiency. The regulation of the system becomes steadily worse with lower power factors, although the increase varies in different portions of the circuit. This condition results in either greatly increased excitation on the generators, or else widely varying voltages at the receiving end of the circuit for varying loads. The capacity of the system for equal heating will be decreased directly with the power factor. This point is modified, however, in the case of the generator fields, which will suffer an increase in temperature with lagging power factors, due to the increased excitation required.

It will be noted that by an investment of a relatively small amount in the condenser, a much larger amount represented by the prime movers, generators, transmission line and transformers, is made available. In addition, the operating efficiency of the entire system is very greatly increased.

An attempt has been made in the foregoing to point out various conditions which make the installation of the synchronous equipment of commercial value. The discussion has been primarily confined to that covering a synchronous motor carrying both mechanical load and condenser load. This is, of course, the ideal arrangement as highest efficiency is obtained from the synchronous machine under those conditions. There is, however, a special application of synchronous motors coming under the classification of "Synchronous Condensers" and divided into two main classes of service. First—the regulation of power factor, merely, without mechanical load; second, the regulation of voltage by means of varying power factors. In the first class of operation, the condenser would probably be installed as a portion of the customer's equipment and would, therefore, probably be removed from the control of the power company. Where a condenser is used, however, for regulating the voltage of a transmission line, the condenser will probably be the property of the owner of the line and will be operated as a part thereof, and moreover will probably be controlled by an automatic voltage regulator.

In the case of the first class for power factor correction only, the synchronous condenser will only be required to deliver leading current and would cost approximately 15 per cent. less than synchronous motor having the same continuous rated capacity.

In the case of the second class for voltage regulation where automatic regulator is used in conjunction with the motor to maintain the voltage constant, the condenser must deliver both leading and lagging current and the cost will be practically the same as a synchronous motor of the same capacity.

a The installation of the synchronous equipment is, however, not warranted in every instance and is a matter which should be given every detailed consideration before the installation is proceeded with.

For any such installation which may be under consideration the matter should be brought down to a dollar and cents basis, if possible. The cost of the new apparatus should be balanced against increase in capacity. Increased operating costs should be balanced against increase in efficiency, and a comparison should be made of the service with and without the condenser.

In general a synchronous condenser will have the most effect and therefore, will be of the greatest value when it is installed at the same point as the load since in this case it benefits all apparatus between itself and the generator. A further gain is obtained by driving a mechanical load in addition to the corrective action of the condenser.

For the average industrial use, it may be taken as a general rule that the synchronous motor having equal motor capacity and condenser capacity, is the most efficient and economical. In this case, the motor will carry full rated mechanical load at approximately 71 per cent. power factor.

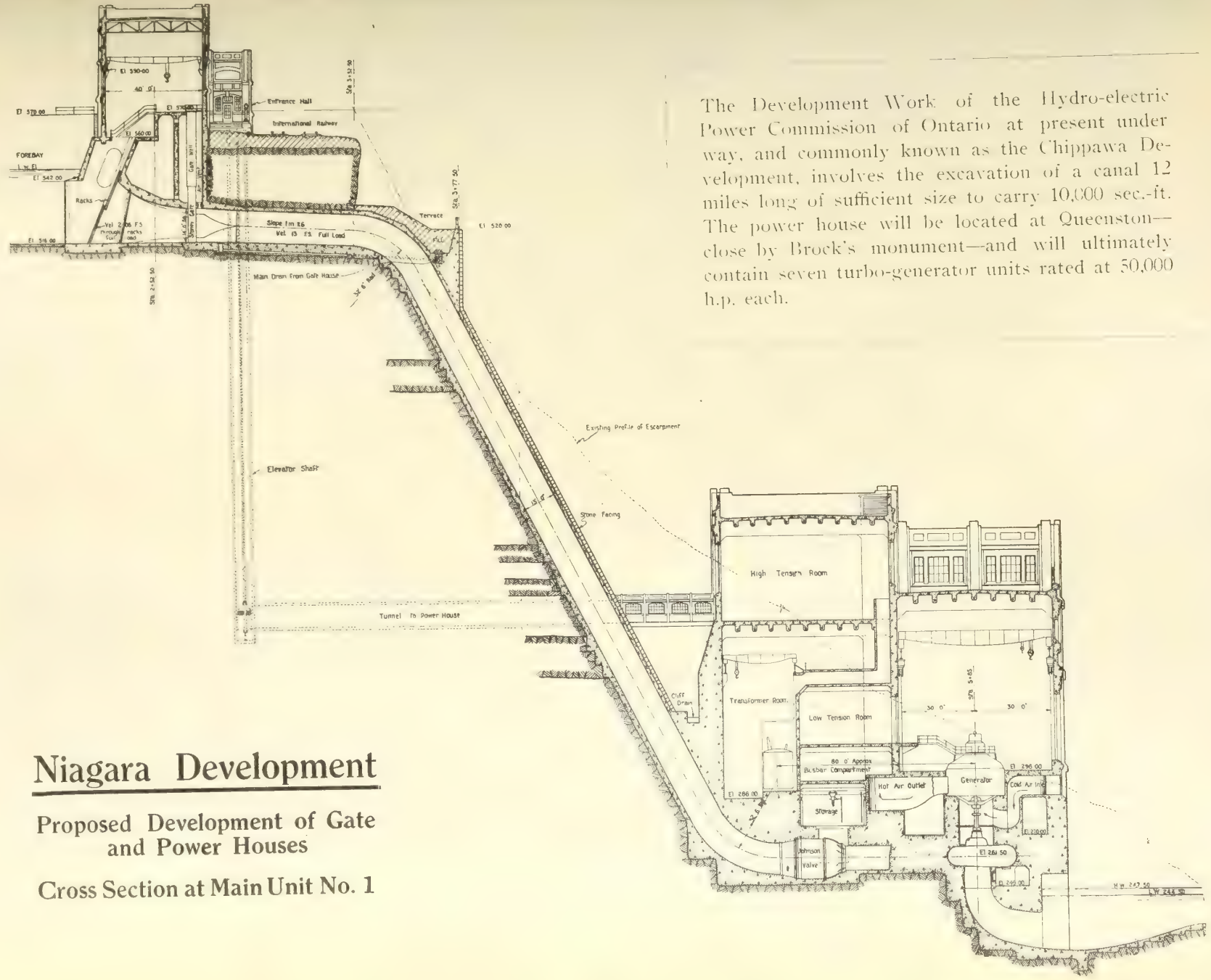
The New 300,000 H. P. Hydro Development

Probably the most interesting item in connection with the convention was the illustrated description of the progress of the work of the Ontario Commission on the 300,000 h.p. Chippawa plant, given by Mr. H. G. Acres, chief hydraulic engineer to the commission. This was followed by an inspection of the work by the delegates who motored over the route.

The plans of the commission have now reached a stage when we are able to reproduce a lay-out of the whole scheme and also a cross-section of the development works at the power-house.

As will be seen from the drawing, the canal encircles the city of Niagara Falls, Ont., having its intake at Hog Island, Chippawa, and its outlet just above Queenston and in close proximity to the famous Brock monument. The total length of the canal is approximately twelve miles. After the most careful study of cost and efficiency figures, it was decided to make an open cut throughout, though for a section of the course where there is a heavy rock cut the advisability of tunnelling was carefully considered. It was shown, however, that the advantages were in favor of the canal even on this section.

The canal follows the course, for about the first four miles of the work, of the old Welland River, in which the direction of the stream has been reversed—that is, the Niagara River is tapped at Hog Island, the water being drawn

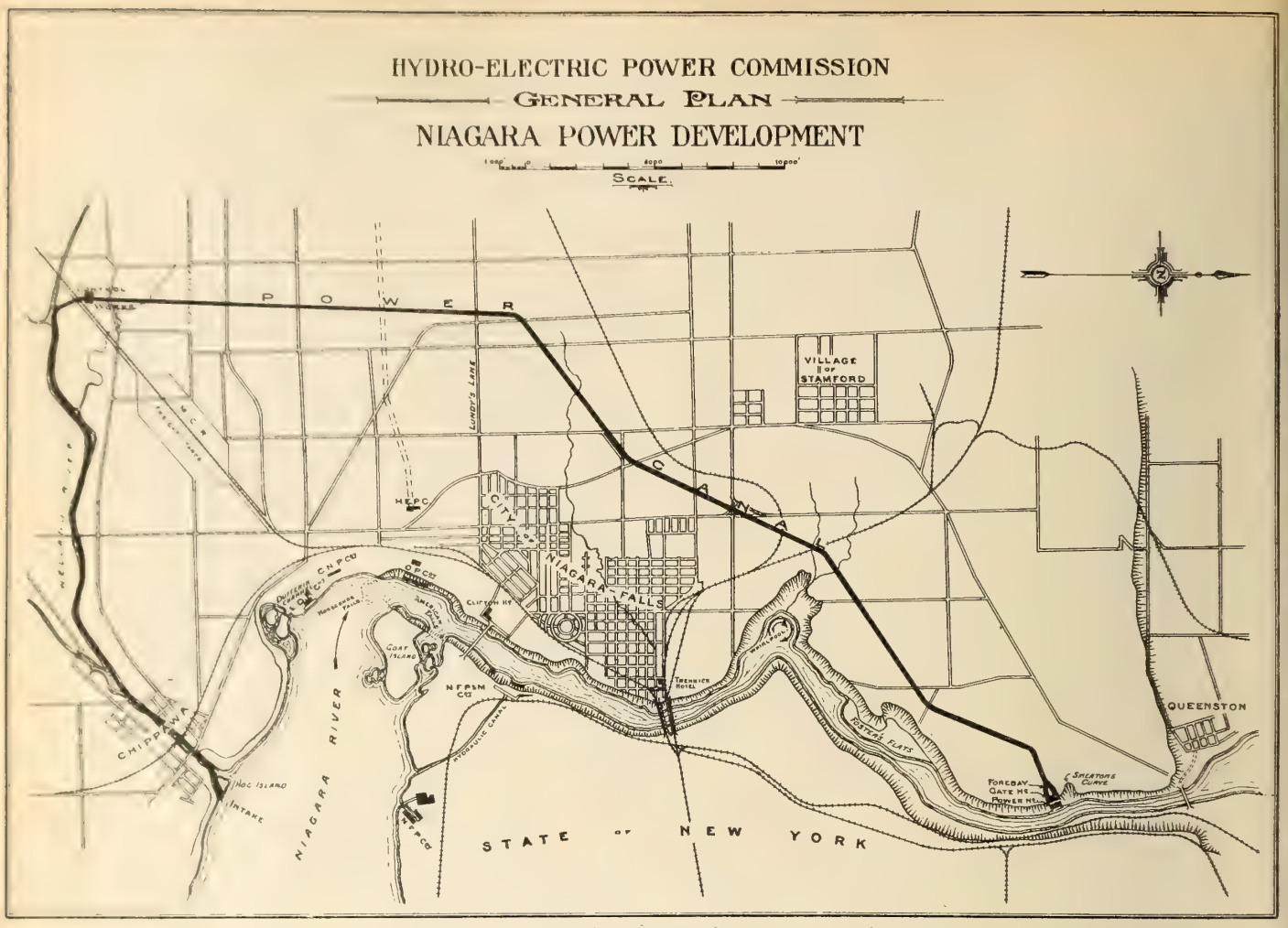


The Development Work of the Hydro-electric Power Commission of Ontario at present under way, and commonly known as the Chippawa Development, involves the excavation of a canal 12 miles long of sufficient size to carry 10,000 sec.-ft. The power house will be located at Queenston—close by Brock's monument—and will ultimately contain seven turbo-generator units rated at 50,000 h.p. each.

Niagara Development

Proposed Development of Gate and Power Houses

Cross Section at Main Unit No. 1



Canal intake at Hog Island, outlet just above Queenston—A 12-mile open cut.

west up the Welland River some four miles before it turns north into the canal. The grade of the canal throughout is such that the current will vary from one to four miles per hour, the velocity over the greater portion of the distance being around the latter figure. At this higher speed there is practically no danger of the formation of ice.

The work of excavation is going along as well as could possibly be expected under all the adverse conditions of the present day. A feature of the construction is the use of electric power down to practically the minutest detail. The engineers of the commission studied this question very carefully and were able to show a saving of almost 50 per cent. over other sources of power supply. One of the features of the excavation work is an 8-yard Bucyrus shovel, also electrically operated.

The canal and all the general works are planned for a development of 300,000 h.p., though it is probable that only 100,000 h.p. equipment will actually be required at the start. A cross-section showing the general plan of the fore-bay, gate-house, generating, and transforming house, is also shown herewith. The total head obtainable according to this drawing is that approximately between elevation 554.0 and elevation 246.0, a difference of 308.0 ft.

The standard width of the canal will be 48 ft. and the maximum depth of cut 135 feet. Approximately one-third of this cut is through rock. The earth sections will be concrete lined as will also the rock sections if it can be shown that a sufficient added capacity would result to justify the additional expenditure.. The penstocks connecting the head gates with the turbine room will be approximately 14 ft. in diameter, and 450 feet in length. This latter figure indicates that the penstocks will be almost in a vertical position, this being possible by the advantageous location of the powerhouse, which will stand at the water's edge under a sheer rock precipice. The turbines will be single runner type, 50,000 h.p. capacity, so that the initial installation will call for two units. Generators will be vertical type, suspension bearings, operating at 187½ r.p.m. and generating 12,000 volts. The ultimate installation will probably be seven such units—six for continuous operation and the seventh as spare.

The work of installation also necessarily includes the erection of a large number of bridges, including accommodation for four railways.

A most interesting feature in connection with the design of this plant is an experimental duplicate, in miniature, at present in course of erection. The results of tests with this miniature plant will be utilized to verify the theoretical conclusions of the commission's engineers and will have a direct bearing on the ultimate design of a number of the details. This plant is nearing completion at Dufferin Island, which is located a short distance above the falls.

The work of installation on the 50,000 h.p. addition to the Ontario Power Company's plant is also going forward, and it is expected this amount of power will be in readiness for the next winter's peak. When the larger development is completed, it is the understanding that the new additional installation at the O. P. Company's plant will be dismantled, this being considered an economical proposition on account of the much greater capacity obtainable from the same quantity of water owing to a practical doubling of the head.

The city council of St. Thomas, Ont., have under consideration the purchase of one-man cars to be operated as a means of reducing the annual deficit.

Canadian Electrical Association Convention

One-Day "War" Session at Chateau Laurier, Ottawa—Valuable Reports Presented—A. Monro Grier, K. C., New President

The 28th annual meeting of the Canadian Electrical Association was held in the Chateau Laurier, Ottawa, on June 21, 1918. On account of war conditions it was decided to confine the meeting strictly to business so as to encroach as little as possible on the time of the delegates. As a result, only one day was given over to the convention.

Following the policy of a year ago, no papers were presented for discussion, the programme consisting almost entirely of the reading and discussion of reports of the various committees. The session opened at 10 o'clock on Friday morning with President D. H. McDougall's address, followed by the report of the secretary-treasurer. Mr. T. C. Martin, secretary of the National Electric Light Association, was present, and addresed the delegates. Mr. Wills Maclachlan gave a demonstration of resuscitation from electric shock, and a brief description of the accident prevention work he is carrying on throughout the province.

The following reports were presented in more or less detail:

Prime Movers Committee Report—Mr. R. M. Wilson.
Overhead Lines Committee Report—Mr. A. A. Dion.
Committee on Electrical Apparatus Report—Mr. J. F. Neild.
Meter Committee Report—Mr. William Volkman.
Commercial Light and Power Sales Committee Report—Mr. H. E. Randall.
Representative of N.E.L.A. Light Sales Bureau—Mr. E. N. Hyde.
Rate Research Committee Report—Mr. P. T. Davies.

A number of these reports are printed in the following pages.

Pressure was brought to bear on Mr. McDougall, the retiring president, and who has held the office for three years, to continue for another year. Mr. McDougall was able to advance sufficient reasons, however, for relinquishing the office, and his resignation was regretfully accepted. Mr. A. Monro Grier, K.C., vice-president Canadian Niagara Power Co., was unanimously chosen to succeed him. The complete list of officers and executive follows:

President, A. Monro Grier, K.C.; first vice-president, E. A. Dunlap, M.P.P., Pembroke Electric Light Company, Pembroke, Ont.; second vice-pres., C. S. Bagg, Montreal Light, Heat & Power Company, Montreal; third vice-pres., A. P. Doddridge, Quebec Railway, Light, Heat & Power Company, Quebec; hon. sec., T. S. Young, Toronto; sec.-treas., W. Volkman, Toronto.

Management Committee—D. H. McDougall, Toronto Electric Light Company, Toronto; J. S. Norris, Montreal Light, Heat & Power Company, Montreal; P. T. Davies, Southern Canada Power Company, Montreal; P. M. McDonough, Quebec; J. S. Gould, Citizens' Electric Light Company, Limited, Smith's Falls, Ont.; H. M. Hopper, St. John Railway Company, St. John, N.B.; Louis Pratt, Dominion Power & Transmission Company, Hamilton, Ont.; J. B. Woodyatt, Southern Canada Power Company, Montreal; W. H. McIntyre, Ottawa Electric Company, Ottawa; E. J. Beaumont, Shawinigan Water & Power Company, Montreal; H. E. Randall, Shawinigan Water & Power Company, Montreal; A. V. Gale, Hull Electric Company, Hull; J. F. Neild, Toronto.

A number of interesting reports were submitted at the afternoon session, and a unique demonstration was given with the assistance of two linemen from the Ottawa Electric Company, who feigned electrocution in order that the delegates might be given an opportunity of seeing the prone-pressure method of resuscitation. The proceedings wound up with a banquet in the Chateau Laurier.



President-Elect. A. Monro Grier, K. C.



Past-President D. H. McDougall, who has just been elected third vice-president of the N. E. L. A.

Report of Committee on Light and Power Sales

In presenting our report herewith, your Committee has followed, with a few modifications, the subdivisions set forth in the report of last year, and has tried to carry out in a consecutive manner the extension of ideas there presented, up to the present time.

LIGHTING SALES

Residence Lighting

The use of semi-indirect, indirect and dense ornamental lighting units has been increasing throughout the past year, due to the softness and uniformity and pleasing appearance of the light obtainable from them, together with the not-too-exorbitant cost of operating such lighting units, brought about by the use of high efficiency lamps, the general tendency today is to make the lighting of the house more in accord with the ornamentation, and to eliminate the use of bare, ugly lighting units in an otherwise artistic room.

This increased use means, in spite of high efficiency lamps, a very materially increased use of electricity, and one which warrants the increasing attention of the central station, and can probably best be handled by the use of specialists who will indicate to the consumer the advantage and disadvantage of various lighting units, and will in this way assist in bettering the class of lighting in residences along the lines of pleasing appearance, softness and uniformity, all tending toward the more secure position of electricity as the ultimate source of artificial illumination, equalling—if not surpassing—daylight. This tendency will undoubtedly react very much to the advantage of the central station.

Store Lighting

The same general conditions which have brought about the softening of the source of light in residences have been even more plainly manifested in the lighting of stores. The present-day merchant is daily becoming more convinced of the usefulness of high grade lighting in bringing customers to his store, and pleasing them when they are there. Window lighting, due to the more aggressive spirit of the stores and the results obtained in store lighting, has made remarkable strides. The use of very high lighting intensities in store windows, properly produced by suitable fixtures concealed from view and distributing the light uniformly over the display, is coming into more general use. This recognition of the value of good lighting of the storekeeper is a fertile field for the central station, due to long burning hours and the large units taken, and should be cultivated intensely.

It is interesting to note that in those sections of the country where window lighting has been reduced on account of power shortage, the storekeepers report that they never realized the great value of proper window lighting until deprived of it.

Industrial Lighting

The central stations of Canada have played an important part in the production of munitions in a way not usually thought of, that is, by assisting manufacturers to increase their night production, and their day production in dark parts of their factories, by adequate, properly designed factory lighting. The effect of such lighting is incontestably to materially increase the production possible with old-time factory lighting, and to make possible a night production equal to the day production. At this time of shortage of man power also, there is the other aspect of a very material reduction in industrial accidents brought about by adequate factory illumination.

The necessity and the usefulness of this type of lighting is so apparent today that every central station should immediately look over its field to determine if it cannot aid in munitions production, or in general industrial activity, by assisting the manufacturers in properly lighting their factories, to the mutual benefit of both the manufacturers and the central station for whom the high load factor of this lighting service should be a material benefit.

Outdoor Illumination

The use of flood lighting for the lighting of large spaces has gone forward rapidly during the past year, for night work on construction jobs, for working in large industrial store yards, and for police protection around plants of every description. The use of flood lighting at night has demonstrated its usefulness in making every passer-by a policeman, thus allowing more efficient protection to our factories, waterworks, and shipyards, etc., without materially increasing police protection with a diminished police force.

A new use which is coming to the front for this type of lighting is the lighting of the area around a burning building to assist the firemen at night and to prevent theft.

Many American cities are now using flood lights, erected on the corners of the high buildings in the busy sections of the city, for intensely illuminating the corners where traffic congestion exists—this supplementing the ornamental and ordinary illuminations existing at these points.

Wherever tried, the reduction of accidents and the ease with which traffic can be handled at night without a policeman has been amply demonstrated, and is leading to the use of this type of lighting for corners in the less congested districts.

Street Lighting

Extensions to street lighting services, due to general war conditions, have not been numerous during the past year, it being the general tendency in those sections where street lighting contracts are expiring, or where new types of street lighting are being considered, to continue with the present type of lighting until a more favorable cost for lighting units exists, as otherwise street lighting services, which are very largely a capital cost proposition, will be materially increased, perhaps to the detriment of proper street illumination. There is a tendency, however, to change from arc lighting systems to high efficiency incandescent lamp systems and to make extensions wherever possible on the incandescent lamp system, due in considerable measure to-day to the lower first cost of the incandescent system, and its lower maintenance cost, thus freeing men for other services. The use of bare incandescent lamps is practically discontinued in sizes over 100 c.p. An extensive use of glassware which properly distributes the light for street lighting purposes is becoming evident.

Daylight saving, which came into effect in this country in the early spring, has not been in effect long enough to accurately determine its effect on lighting income, but it would presently appear that lighting income during the summer months will be decreased some 10 per cent., which, however, will probably be made up by the increased use of light which generally follows upon a reduction of lighting bills, which should be of considerable assistance in increasing lighting income during the winter months; so that although this feature should be carefully reported on next year, it is probable that the gross income over a year's period from lighting service will be actually increased after a few years' operation of the daylight saving law.

Moreover, the increased demand for domestic service as set forth later in this report, will, during the summer months, if properly cultivated, more than offset the slight

decrease in lighting income which will exist during this year and for a few years to come.

General

It seems evident that the tendency to-day is for the consideration of electric lighting, not merely as a plain, ugly source of light, but as a means of producing a soft, pleasing, properly distributed, artistic illumination, which can be obtained at low cost, and which is beyond competition. The uses of light in an industrial way are playing an important part in business and in the production of munitions, and this role is becoming much more generally recognized. The central station may, therefore, with some degree of satisfaction review its activities in the lighting field over the past year, and should endeavor to play a still more important part in the lighting field in the years to come.

POWER SALES

The demand of the central stations for the supply of power in large quantities on short notice to munition plants has continued and increased throughout the past year. The supplying of this power has in some sections of the country produced an acute power shortage, which has occasioned more careful study of power delivery conditions to munitions plants.

Such studies have in many cases indicated that the supply of power to these plants, which was assumed originally to have been of a very temporary nature, was carried out over lines which were of small capacity and which occasioned very heavy losses in power as the manufacturers increased their loads. In many instances the handling of these loads, or increases thereto, has been more satisfactorily carried out, both from a service standpoint and a saving in power standpoint, by the delivery of power to the larger munitions plants over high tension circuits with transformer equipment at the manufacturing plant.

Power demands have also increased materially, due to coal shortage, which has again brought to the front the more economical production of power by central station means, as demonstrated by the Fuel Controller's coal saving through the use of central station plants for power supply rather than the isolated plants in the various factories.

Those central station companies generating by hydraulic power are in this way very materially assisting in the elimination of the coal shortage, and thus helping in the solution of the transportation problem.

The power shortage has called to the attention of the companies suffering from it the necessity of being much more careful in their sale of power, and the conditions of sale, among which perhaps the most important is the regulation of power-factor. In the past, due to loose power-factor conditions and non-enforcement thereof, power lines have become encumbered with motors of excess capacity or of improper voltage, or improperly repaired, with the result that many companies were supplying motor loads at a very low power factor, materially decreasing their line capacity, their generating station capacity and transformer capacity, all of which is so urgently needed at the present time for munitions and general purposes.

Most companies throughout the country are now strictly enforcing their power-factor regulation clauses, or writing in new power-factor clauses in their new contracts, with the result that the users of power, due to penalties involved for poor power-factor, are readjusting their equipment to operate at a proper and reasonable power-factor, which has worked very much to the benefit both of the central station and of the consumer.

The power shortage in some sections of the country has made necessary the curtailment of the supply of power to non-essential industries, and if relief is not afforded will tend to the complete elimination of power supply to such industries. It would seem to your Committee that provision should be made, by government assistance or otherwise, just as much to the power company as to the munitions manufacturer, inasmuch as the power company is supplying one of the most important raw materials—that is, power—to so enable the power company to maintain its business so that the normal manufacturing activities of the country may go on, thus tending to stabilize the industrial conditions in the country after the war, and in many instances allow the establishment or expansion of industries to supply export demands which were previously supplied from Germany. If this country is to maintain its industrial place and to make this place a more important one, the activities of legitimate, normal industries of the country, even although not strictly employed on munitions work, should be encouraged and assisted in every proper manner, and should by no means be allowed to be stamped out, due to a shortage of power.

We also feel that new applications for power supply for motor power uses should be met insofar as is physically possible, inasmuch as it would build up the industrial activity of the country and make for a more stable condition after the war.

Domestic Service

Nowadays the use of electricity in the home is far from limited to the simple electric light, but it is becoming more and more important for other domestic uses, such as toasters, grills, percolators, flat-irons, vacuum cleaners, washing machines, dish washing machines, sewing machines and other small motors, and to a larger degree the electric range and electric water heaters. Your Committee, therefore, believes that this report should comprise a section devoted to these domestic uses of electricity outside of electric light, as these bid fair to far surpass the income from domestic electric light, and under present-day conditions serve also as important conservers of fuel, thus aiding the national cause.

The use of the smaller of the household appliances noted above has increased greatly during the past year, due to the difficulty experienced by householders in obtaining domestic help, and they have, therefore, turned to this "universal servant" for assistance and have been in this way made familiar with the great assistance that electricity can offer through the above appliances.

The familiarity with domestic electric appliances which the householder has thus gained, and the absolute success of these appliances, make it easy for the central station to get a very much increased amount of this business during the present year, and campaigns with this in view should be carried out.

The most important source of domestic service revenue is the electric range, from which an income of between $35 and $75 a year can in general be secured, which is many times the income from the same householder for lighting service only.

At this time the use of electric range becomes more and more important as it is a conserver of fuel, even though the electricity is generated in a steam generating station. The average range will consume something between 10 and 175 kw.h. per month, which generated in a modern steam generating plant would not require more than 200 to 350 lbs. of coal, whereas the ordinary coal range consumes some 600 to 1,000 lbs. a month, thus making a net gain of approximately 60 per cent., which if applied to all the householders of Canada would mean a tremendous difference in the congestion of our railroads and the amount of money sent out of the country for coal. Of course, where water power is the source of electricity, the net saving of coal is 100 per cent.

All companies having available power and who have been supplying electric ranges previously report tremendous increases in the use of electric ranges, which amply demonstrate their success.

We therefore recommend that every central station im-

immediately investigate carefully the electric range possibilities and make suitable rates therefor, as we feel the income to be thus obtained will be a most important factor in the central station industry in the very near future.

We further recommend that the sale of all electric ranges be carried out on an installed price basis, so that only one sale has to be made covering complete range, as it is found that where a range is sold by itself it is sometimes difficult to make the sale of the installation on account of its excessive cost in certain sections of the country.

In those cases where the central station does not do the installation work, this basis can still be used by co-operation with the contractors' association or the contractors in the various cities.

As electric cooking represents a new and advanced type of cooking, it is very necessary that central stations going after the electric range business should be prepared to furnish adequate service, preferably by means of a competent demonstrator, so that all purchasers of ranges will be properly instructed in their operation, and during the first few months of operation periodical inspections should be made to ensure that everything is operating satisfactorily, and that the purchaser is obtaining all the information which will lead to the fullest success of the range. The purchaser should be made to feel that attention to details or repairs or any defect with the stove will be immediately and satisfactorily taken care of, and that when a purchaser takes an electric stove he is going to be absolutely satisfied therewith.

While this service is very necessary at the present time, later, when the use of electric cooking becomes universal, and as standard stoves are developed, the necessity for this service will probably disappear, as it has in the gas business.

It is already noticeable that manufacturers are following up the suggestions made by the central stations and are in this way obtaining what will soon become a standard range, which will be practically free from minor defects, and which will require practically no attention. The central stations should continue this policy of suggestions, because they are in the best position to determine the slight defects which exist and the slight changes which may be necessary to perfect the electric range, and we feel certain that all range manufacturers will be very glad to get the suggestions from central stations.

Electric water heating is becoming more and more common on all services supplied from hydraulic plants, and, as stated in last year's report, it seems certain that the electric water heater should always be installed whenever an electric range is installed on systems with such a source of power supply. Marked improvements and betterments in electric water heaters have been brought about during the past year, and heaters now available are giving excellent service. On those installations on electric water heaters in which furnaces are used for water heating in the winter time and the electric water heater only used in the summer time, water heating load gives a more uniform yearly load curve for the installation, as it is thus prevented from overlapping the lighting peak in the winter and fills up the valleys of the load curve which normally exist in the summer.

Most central stations are supplying water heater services on a flat rate basis, either directly or on a double throw switch, so that electric stove and electric water heater cannot be used simultaneously.

Other Uses

Arc Heating Processes during the past year have expanded in use by the industries reported last year. Calcium carbide, ferro-silicon and steel have very largely increased, probably in the total by 50,000 h.p., whereas the production of zinc by arc process has been discontinued. The use of the electric steel furnace for average steel foundry practice seems to have become assured, as for the average small foundry it offers a means of making a superior steel at low cost and with a freedom from uncertainty which is quite impossible with the methods hitherto used. It is probable also that electric furnaces of this type will also be used for grey iron casting, and it might be that in small foundries, casting both iron and steel, the same furnace be used for both. Central stations should look over their field of operation and call the attention of steel foundries to the use of the electric furnace.

Resistance Heating Processes have increased materially, notably for calcining coal and the manufacture of carbon electrodes, and very largely for abrasives. During the past year the use of electrically-heated japanning ovens has grown to a large extent, both for light sheet metal products and for heavier products. This type of load being a very high load factor is very desirable for the central station.

Electric Welding has advanced materially during the past year and seems to be now expanding in usefulness for the heavier welding processes. Spot welders are becoming almost universal in replacing light riveting processes.

Electric Bake Ovens have been installed in many places in Canada and are giving universal satisfaction, turning out a superior quality of bread at very low baking cost. This use of electricity is destined to largely expand in the near future and offers an attractive use for off-peak power, although the business readily stands the firm power rates. The use of electrically-heated muffle furnaces for heat treatment and other purposes is expanding considerably, and the use of small electrically-heated melting pots for base metals is commencing.

Electrolytic Processes

No material advances to electrolytic processes have taken place during the past year except for the production of hydrogen, oxygen and chlorine. Electrolytic generators for hydrogen, oxygen and chlorine furnish a cheap and easy means for the production of these gases in relatively small quantities for industrial uses. Industries requiring these gases are becoming more and more numerous, and, due to the difficulty of obtaining these in the open market, many companies are installing their own gas generators.

Industrial Trucks

During the past year the use of small storage battery trucks and tractors has increased considerably. These trucks are used in industrial establishments for moving materials through the plants, in railway stations for handling baggage, mail and express to and from trains, for freight terminals, steamship docks and a great many other purposes. These trucks replace a great number of men used as truckers, and not only free them for the national service, but materially decrease the cost of service. This load, being in general an off-peak battery charging proposition, is a very attractive one for the central station. This report of your Committee is intended to concisely state the advances in electric lighting and power sales which have taken place during the past year, and advances in the use of electricity. A review of this report must indicate the tremendous value of the central station industry to the country and the most important part that it is accomplishing in the production of munitions, in the advancement of industry in the solving of the servant problem in the home, in the conservation of fuel and thus in transportation, the conservation of man power, and in many other ways—all materially assisting in the attainment of the success of our national efforts and in the building up of the industrial condition of this country, not only to be of service in winning the war, but to be of service in the general upbuilding of the country after the war.

Respectfully submitted,

W. H. McIntyre, F. M. Dusenberry,
L. W. Pratt, M. C. Gilman,
H. E. Randall (Chairman). R. B. McDunnough,

Rate Research Committee Report

To the President and Members of the Canadian Elec. Assn.:

Gentlemen:—

Your Committee reports that they have carefully watched the trend of current events with a view to incorporating in their report any changes in rates or any tendencies in public opinion and have noted the following matters as being, in their opinion, worthy of notice. Using the chart which was designed last year as a basis for their investigations, they have looked into the following matters:

Contracts

Legal Arbitrations—An outstanding matter for Canada has been the settlement of the Tramways Franchise in the city of Montreal by a Board appointed by the Provincial Government. The matter of a new franchise for the city of Montreal and its surroundings has been the centre of political agitation for a matter of some six years, but in the fall of 1917 the matter was taken out of the hands of the civic authorities and placed in the hands of a commission, who had authority to study the details and had to report back to the provincial government their ratifications.

The contract, or franchise, as finally approved is a three-sided agreement whereby the company is protected in its investment, the public protected on the rate of fare, and the city is protected on the point of view of taxation, and general conditions involving routes of cars and maintenance of service, etc. The agreement is a very long one, but the special point worthy of notice is the fact that the company is permitted to charge fares which will cover their bond indebtedness and up to a reasonable percentage on the common stock. After providing for renewals and the city's portion a fund is created into which all surplus earnings are placed. When this fund exceeds a certain amount, the fares are automatically reduced, and if the reduction does not effect this fund then further reductions may be ordered. If, however, the fund is eaten into then rates are automatically raised again.

The interesting point about this agreement is that the province of Quebec has followed the lines of the United States Government in protecting privately owned public utilities, and, at the same time, protecting the public. While this policy has been in force throughout the United States for the past eight or ten years, and is continuously becoming more widespread, in Canada on the contrary, privately owned public utilities have regularly been singled out for political activity with a resulting insecurity of investment, which has tended, especially in Ontario and the West, to curtail their development.

Obligations

The obligations of customers in Canada in view of the shortage of power and high cost of machinery have been increased in the matter of providing proper apparatus, especially with a view to the employment of power factor, whereas in the past power factor clauses have not been vigorously applied. Nowadays nearly all companies are requiring the customer to keep their power factor within reasonable limits at all times and to pay for any deficiencies. The question of the measurement of power factor as to whether same should be computed to the time of maximum load on the consumer's installation or to the time of maximum load of the company's system, or whether the average power factor taken by the customer of the whole period of his operation should be taken as the determining factor is not yet standardized.

Special.— In the matter of rates for summer business, it is a known fact that no meter rate can properly produce enough revenue on the average summer customer to pay the interest on the investment, and it should be noted that in the United States rates as high as 18c per kilowatt hour have been tried.

One of the member companies has instituted a new type of rate this year with a view to getting, at least, fixed charges out of these customers, the rate being $1.00 per outlet for the first 10 outlets plus 50c per outlet for the excess over 10, payable in advance, plus 4½c per kilowatt hour. It is found, generally speaking, that summer customers get away without paying their last bill and are very difficult to trace. In the case of the above rate a good deal of the charges are being collected in advance, and the company does not stand to lose so much revenue from "skips."

Cooking Rates.—A study of the rates charged for electric cooking in the United States shows that the prevailing rate is 3c per kilowatt hour for straight cooking. While this may seem high to those who are accustomed to the low rates prevailing in Winnipeg and Ontario, nevertheless, electric cooking is within the economical reach of anyone who has ever used gas or oil stoves. An average taken over a number of cases shows that for cooking in the average family that 25 kilowatt hours are required per person per month, and at the above rate of 3c this represents 75c per head. After five or six persons are catered for the usage per head drops off very fast and the usage of over 200 kilowatt hours per month is quite exceptional. Various rate forms are being tried out by member companies for electric cooking, but the committee has no hesitation in advising member companies that a 3c net rate is an acceptable and profitable rate.

Revenue

Measurements.—No new instruments have been devised for the cheaper measurements of maximum demand, and the lack of such instruments is still felt. The same thing applies to measurement of power factor.

Psychology

Expediency—Political.—The Rate Research Committee feel that they can hardly present their report without referring to the political significance of the shortage of power in the Niagara district, as this is a case where political action has resulted in a curtailment of necessary supplies which may have a very important bearing upon the positions of the allies in the great war. In the Niagara district, on both sides of the river, are many plants whose output is essential to the successful prosecution of the war, this output being absolutely dependent on the supply of power. Political action placed these plants, at any rate on the Canadian side—where they are, although in other parts of Canada ample power was available, and is still available for their requirements.

The output of these plants has been regularly and seriously curtailed owing to the fact that the political machine in Ontario over-sold their output in a blind manner, and gambled upon Providence helping them out. Even today it is reported that the output of the plants, instead of being supplied to the necessary and essentiail war industries, is being diverted to light up the small towns and villages far distant from the plants. The political significance of this action is only equalled by its immorality.

Bibliography

The weekly issue of the rate research bulletin of the N.E.L.A. will keep the member companies supplied with the

most recent information, and those of our member companies who are not subscribing to it are strongly advised to do so.

Cost of Service

The cost of service has naturally raised in all parts of the country, but it is with pride that the electrical industries in Canada can point to the fact that the cost of service to the ordinary consumer has not yet been advanced. In the case of short term contracts on munition business higher prices are now obtainable than originally, but in most cases the rates charged are in no way comparable with the cost of any other kind of service.

Taxes.—The Committee find that the original chart did not include the sub-heading "Taxes," and are, therefore, including one. In the point of view of taxation, a new impost has been developed in one of the towns. This consists of a tax of 25c per month on all users of electricity. This tax was successfully passed over to the consumer, although the company supplying the current has tried to do the collecting. While any tax of this kind is liable to become general, member companies are warned to take steps to see that the tax is placed on the consumer and not on the company, and, secondly, that such tax is kept as low as possible, as even 25c per head has had the effect of causing some users of electricity to discontinue same.

The whole respectfully submitted:

A. A. Dion,
M. C. Gilman,
J. B. Woodyatt,
P. T. Davies (Chairman).

Report of Committee on Electrical Apparatus

Your committee herewith submit the following notes on the progress in the development of electrical apparatus.

The past year has been one of high pressure in business, the insistant demand for electrical machinery, particularly motors of all kinds, has forced the intensive production of standard types, and this has no doubt in many ways re-acted in delaying the normal advancement of the development of electrical apparatus.

There has been a wide expansion of the application of electrical processes in the metallurgic and chemical industries, causing many problems to arise in heat control, speed control, protection, etc., and these should prove a very fruitful field for an interesting report in the future.

The development of remote control, self control and automatic synchronizing and paralleling devices and the ruggedness of machines, has made possible the automatic substation. The fact that motor generators and rotaries are now left to run virtually unattended, speaks eloquently for the progress in machine design, and in these days of labor shortage and the necessity for economy, the automatic sub-station should receive the widest possible attention.

In alternating current generators, no radical changes appear, but the mechanical improvements permit of higher speeds in larger units. A horizontal waterwheel generator rated at 20,000 kv.a., 660 volts, 60 cycle, and operated at 360 r.p.m., represents the limit of this class as attained at present, while in the slow speed machine, a 10,000 kv.a., 6600 volt vertical waterwheel generator, 60 cycle, has been built at 55.6 r.p.m.

In alternating current motors, the speed control question is developing, and now, motors of 220 h.p. are made with a speed range of 430/300. With auxiliary speed control apparatus, the synchronous speed disappears, and control can be maintained in most cases without sacrificing torque.

In heavy duty motors for mill work, progress is being made especially in the reversing drive type, and installation has been made of a 22,000 h.p. unit. This is a double unit consisting of two motors electrically in series on a common base. The current is supplied by a flywheel type motor generator consisting of three units electrically in series.

In the question of transformers, the principal improvement lies along the lines of better insulation distribution, and greater ability to resist the mechanical forces imposed by short circuits. These results are obtained by using circular coil construction.

The development of single phase self cooled transformers up to 8,000 kv.a. has resulted in a type of cooling apparatus using external radiators, combined with the standard corrugated case. Oil conservator tanks are also used. In this arrangement the transformer cases are air tight, and are completely filled with oil, the expansion being taken care of in the external conservation tank usually placed on top of the case.

In direct current motors, the principal advance has been in speed control, being obtained by an auxiliary winding embedded in the main pole pieces, additional to the commutating poles. This compensating winding practically prevents flux distortion losses, permitting rapid acceleration from low to high speed.

The question of service, particularly on high tension power lines, is demanding effectual relay application, and today important feeders are no longer affected by troubles being allowed to spread.

These results are largely brought about by the application of balanced currents with instantaneous overload relays of the single plunger type or with relays of the induction type.

The single plunger relay is now a more rugged piece of apparatus, and is proving capable of the heavy duty at times imposed on it.

The great advantage of the induction type relay is the accuracy and permanence of the calibration.

Your committee wish to express their appreciation to those who have assisted them.

Respectfully submitted,

J. F. Neild, Chairman,
Committee on Electrical Apparatus.

New Use for Vacuum Cleaner.

During the recent Red Cross campaign in New York City one of the features was the use of a vacuum cleaner to extract coins and bills from the crowds that assembled around the speakers' stand. The long tube was thrust out into the crowd and the money placed at the opening was quickly whisked out of the donor's hand into a bag at the rear. The novelty of the scheme added not a little to the sum total of the campaign.

Canadian Westinghouse Secretary is Dead

Mr. John H. Kerr, Secretary of the Canadian Westinghouse Company, died at his home in Hamilton on June 24, after a brief illness. Mr. Kerr was born in Pittsburg and was associated with the Westinghouse Electric and Manufacturing Co. as early as 1892. When the Canadian company was organized in 1903 he then was appointed secretary and has since resided in Hamilton.

Report of the Meter Committee

Owing to the great and pressing needs brought about by the war there has been little time available for manufactures of meters to devote to new developments, so that in going over the field we find very little change during the past year.

Watthour Meters.

The General Electric Company standardized their 1-14 watthour meter for general use about three years ago. This meter is still standard with them and no changes have been made in the design.

The Canadian Westinghouse Company have developed a new single phase watthour meter known as the Type CC, which now supercedes the Type C in sizes from 5 to 20 amperes, two wire. In designing this meter, simplicity of construction, calibration and manufacture have been given great attention, all parts are made on an interchangeable basis, and the assembly of parts is checked by gauges so that very little variation is found in the product. All wearing and calibrating parts are readily accessible so that the costs of repairing and checking are reduced to a minimum. The tests on this meter show a performance considerably better than the Type C. The 60 cycle meter load curves show a variation of .2 percent from no load to 75 per cent. overload, and a drop of .8 per cent from 75 per cent to 100 per cent overload; the performance of the 25 cycle meter while not as good as the 60 cycle is much better than the Type C. The load curves vary about .3 per cent from no-load to full-load with a drop of 1 per cent at 50 per cent. over-load and 2.2 per cent at 100 per cent over-load. There is little change in the accuracy for voltage variations 10 per cent above and below normal.

The Sangamo Company have made no changes in their type H. meter which has been their standard for the last two years. It might be of special interest, however, to note that the Sangamo Company are now assembling all of their meters and manufacturing 90 per cent. of the parts in Canada.

The Packard Company have made changes in the design of their Type K. induction meter which overcomes the previous difficulties encountered in their product.

There have been no changes in the line of d.c. watthour meters during the past year which have come to the attention of your committee.

Graphic Wattmeters.

The Westinghouse and General Electric Companies have made no changes in their line of graphic meters during the past year.

The Esterline Company have made some changes in design on their type E.B. meter which will considerably increase the usefulness of this meter. We understand, however, that these improved meters are not as yet in production, so that it will probably be three or four months before they become available to the trade.

The Bristol Company have developed a line of graphic strip recording meters for a.c. and d.c. of the dynamometer type. The electrical design has been given very close attention so that these meters should prove very acceptable to the trade. The clock mechanism is very substantial and is arranged for a normal speed per hour and a special speed by moving a lever of the same speed per minute.

Indicating Meters.

Switch-board type—There has been very little change in the general lines of switch-board meters during the past year, the principal changes being entirely along the lines of smaller meters, so as to decrease the amount of switch-board space required. All companies manufacturing these lines now have a line of small meters.

The General Electric Company have placed on the market a miniature round pattern a.c. ammeter approximately 3 in. diameter, similar in appearance to their direct current instrument Type D.M. This instrument has a rolled bakelite cover and drawn brass cover with full glass dial.

A new line of "fan-shaped" instruments has been placed on the market by the Weston Electrical Instrument Company. These instruments are of the permanent magnet type and are d.c. voltmeters and ammeters for switchboard mounting. There are four sizes known as models 267, 269, 271, and 273. The principal dimensions of model 267—4-5/64 in. wide x 3⅜ in. high x 1 3-32 in. deep, scale length 2.5 in. and the large instrument, model 273, dimensions are 9-5/16 in. x 7-31/32 in. x 2-1/16 in., scale length 7.6 in. These instruments have remarkably long, open and legible scales, the longest scale ever attained in instruments of their size. The scale arc is 120 degs. as against about 86 deg. for the round pattern Weston meters of similar principle. The shunt drop of the ammeters is 50 m.v. and the voltmeters have a sensitivity of about 100 ohms per volt. Each model has a wide list of standard ranges, for instance, model 267 voltmeter being listed in 38 ranges from 50 m.v. to 150 volts, and the ammeter ranges run from 1 amp. to 150 amps. in 21 capacities all self-contained to 30 amps.

Laboratory Instruments.

A laboratory standard line of voltmeter, ammeter and single phase wattmeter known as the Model 326, has been developed by the Weston Electrical Instrument Company. These instruments are of the dynamometer type and are for a.c. and d.c. service. These instruments are conservatively guaranteed to be within 1/10 of one per cent on direct current or an alternating current up to 133 cycles, or if specially ordered up to 600 cycles. They are compensated for temperature, are air damped and shielded from external magnetic and electrostatic influences. The scales are provided with mirrors and are sub-divided into fifths by means of diagonal lines intersecting with six concentric arcs. The length of the scale is approximately twelve inches. The instruments are provided with zero correctors, spirit levels and adjustable leveling screws. The wattmeter is entirely compensated for phase angle errors and the current circuit is designed for 100 per cent. continuous overload.

Demand Meters.

The determining of customers maximum demands is probably one of the greatest problems of the meter engineers at the present time. For large customers this is not as great a problem as for the small customers, for in the former case the power company is justified on account of the greater revenue in installing the more expensive meters now necessary to determine the maximum demand, but for small loads this method cannot be considered.

There are on the market at the present time quite a number of definite time maximum demand meters manufactured by the different companies, but practically all of these meters are open to the objection that if a customer's maximum demand does not occur in synchronism with one of the definite time periods, the actual maximum demand would not be recorded. The problem of obtaining a customer's

maximum demand by the definite time demand meters depends, of course upon the type of load being supplied. In other words, the nearer a customer operates to 100 per cent. load factor, the more accurate this method becomes. Similarly, if a customer's maximum demand occurs only once or twice during a month, and this maximum demand is considerably above his average load, the operating company is liable to lose as high as 50 per cent. of its revenue.

From a meter or engineering standpoint the ideal is to be able to obtain the absolutely correct maximum demand at whatever time it occurs. However, since the present range of meters are not always practicable for this purpose, compromises are necessary between the rate charged for power and the method of determining the amount of power used, so as to insure the requisite return to the power company for services supplied.

Probably the latest development in the line of maximum demand meters is the Westinghouse Type R. H. meter, wheih is built on an entirely new principle. This meter is operated on a thermal and heat storage basis. A coiled thermostat, the temperature of which is directly controlled by the amount of kv.a. in the circuit, is enclosed in a metallic case. This case is made light or heavy, depending upon the length of demand period desired. Upon any change in load the temperature of the element begins to change and continues to do so until the rate of heat loss is balanced by the rate at which energy is being supplied. The change in temperature takes place according to a logarithmic law, and it is in this respect that the meter gives an entirely different type of maximum demand from that given by the straight line electro-magnetic meters. The meter is designed on a 15 and 30 minute basis.

The principal feature claimed on this meter is the fact that it takes into account the heating of generating equipment as it follows the same general laws. However, while this is true the adoption of the meter would mean an entire re-arrangement of rates and contracts in order to insure the operating company the necessary income.

Power Factor Determination.

One of the greatest problems which the operating companies have to face at the present time, owing to high costs of material and long deliveries, is the question of getting out of their available equipment 100 per cent. value. Wherever a.c. power is used for power purposes the capacity of lines and apparatus must be greater than would actually be necessary if we did not have to provide for the wattless energy of customers apparatus.

The meter to be desired for this purpose is one which will record volt amperes directly. Considerable time and money have been spent in an attempt to design a meter of this type, but as yet none have been produced. The Westinghouse Type R. H., however, comes closer than any other since it is operated entirely on the thermal principle which, of course, takes the wattless component as well as the watts.

Discussion.

At this time, when central stations are confronted with the problem of handling an ever increasing load over existing lines, and are confronted with extremely high cost for additions to line capacity, the relief which can be obtained by the bettering of power factor of consumers' loads is of prime importance.

Those companies which in the past have not paid particular attention to the power factor of their customers' loads, and have made no provision for a reasonable power-factor, or have made such provision and have not enforced it, have found, upon investigation, that in general the power-factor of these consumers' loads is extremely low, and instances of 60 per cent. and less are by no means rare. If the power factor of the consumers' loads was increased to some reasonable figure, say 85 per cent. to 90 per cent., the carrying capacity of secondary lines for the same voltage drop would be more than double, and a corresponding saving in power lost would result.

In the past, there seems to have been no standard clause covering the regulation of power factor in power contracts, but one of the larger power companies has the following clause, which would seem to adequately cover the entire correction of power factor, either for power sold on a maximum demand basis, on a kilowatt hour basis, or on a mixed rate, as follows:

> "If at any time, when the power is being delivered to the purchaser at normal voltage and frequency, the total volt-amperes so delivered exceeds that which would result if the power which the purchaser is then taking hereunder were delivered at a power factor of 85 per cent., the volt-amperes delivered shall be calculated as power upon the basis of 85 per cent. power factor."

and in this regard, it should be noted that the determination of power factor, which is to be used as a basis for penalty, requires a materially different method of determination when applied to maximum demand power or when applied to kilowatt hour energy consumption.

Some companies have adopted the practice of writing into their contracts the statement that kv.a. for billing purposes is to be taken as the kw.; this is applicable to both the maximum demand method and kilowatt-hour method. This method, of course, is only applicable to special contracts, where the rate can be readily changed, i.e., it would not be entirely fair where definite power rates are established for an entire community unless all contracts are written to contain the clause.

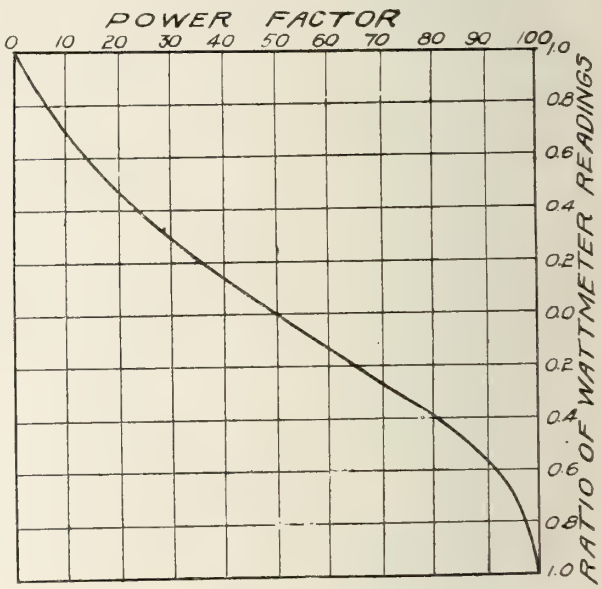


Plate I.

It would, therefore, seem of importance to outline the means and methods available for the determination of the power-factor of the consumers' loads; in order to properly apply the penalty in case of low power-factor, which will sooner or later result in the bettering of the consumers' low power-factor, and in the meantime will allow the power company a reasonable return on the line capacity used for the supply of power to low power-factor loads, which could otherwise be employed for the supply of new consumers.

Methods.

1. The instrument first brought to mind to obtain some

record of power-factor, is some sort of power-factor recorder or indicator. These instruments have, however, not been found satisfactory by several of the member companies, in that they require at least 60 per cent. of full load to be of sufficient accuracy to warrant their use, and also in that they are least accurate at low points of the scale, where most penalty power-factors lie. One of the member companies has gone so far as to abolish their use entirely, replacing them by a graphic watt meter, connected to read the wattless component on consumers' loads, and even in power stations. For these reasons, these instruments can be assumed as unsatisfactory for our purposes.

II. The simplest and most obvious method of determining average power-factor is by the use of either two

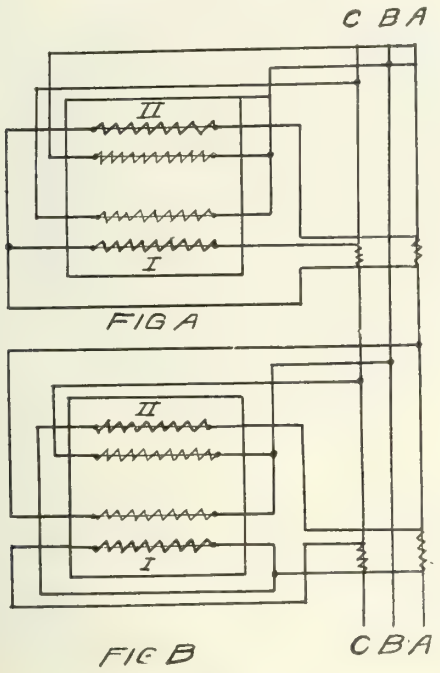


Plate II.

single phase meters, or one single-phase meter in connection with a polyphase instrument, which gives the total energy consumption. This method is of course applicable in cases only where the consumer is charged on a straight kilowatthour rate, or on a mixed rate basis. This method assumes exact balance of load, and is not applicable to loads which are badly unbalanced. On large loads of induction motors, however, there is no objection to using it, as very closely balanced loads are the rule.

Assuming balanced load, then, in any three-phase circuit, the reading of one single-phase watthour meter will be

$$W_1 = VI \cos(\theta + 30^\circ)$$

while

$$W_2 = VI \cos(\theta - 30^\circ)$$

will be the reading of the second single phase meter.

The sum of these two quantities may be shown to be the total power in the circuit, while the ratio of their sum and difference may be reduced to the following quantities:

$$\text{Tan } \theta = (W_1 - W_2) \div (W_1 + W_2)$$

therefore, the angle of lag may be found from which the cosine or power-factor may be taken from any table of natural functions.

An easier method, perhaps, of determining power-factor is to read off the value of power-factor from a curve plotted between power-factor and ratio of watthour meter readings. One familiar form of this curve is shown in Plate I attached, the ratio being expressed as less than one, that is the ratio of the smaller to the larger reading.

In cases where single-phase meters are employed, in connection with polyphase meters, the reading of the former is to be subtracted from the latter, the ratio being taken between the difference and the reading of the single-phase meter, or vice versa, as the case may be. The average power factor is then determined from the curve, and the total consumption increased in the ratio of contract power factor to the actual value.

Metering Badly Unbalanced Loads.

III. In cases of badly unbalanced loads, or in cases where power is sold on a maximum demand basis, the above method is not applicable, and it becomes necessary to use equipment which will give the average power-factor of an unbalanced load, or power-factor at the time of peak.

One method available to determine average power-factor under these conditions is by connecting a standard watthour meter or graphic wattmeter to read proportional to the wattless component of the load. This method was partly described by H. S. Baker before the 1911 convention of the Canadian Electrical Association. This equipment used in connection with ordinary apparatus giving true power or energy offers a means of obtaining power factor at peak.

In plate II., Fig. A, is shown the standard connection of a meter to read true power, or the energy component of the load. Fig. B. shows the connection in which the indication is proportional to the wattless component, in which it is noted that the current in element I of the meter is reversed, while the potential of element I is taken from phase B.C. instead of B.A.; the current of element II is unchanged but its potential is taken from phase B.A. instead of B.C. It may be shown that with the meter connected in this manner, the indication is equal to $2\ VI \sin \theta$ for balanced loads, and for unbalanced loads, it is still proportional to the wattless component. By multiplying this indication by 86.6 per cent., the true wattless component is obtained. Therefore, from the corrected reading of this meter in connection with reading of true power, the angle of lag, and

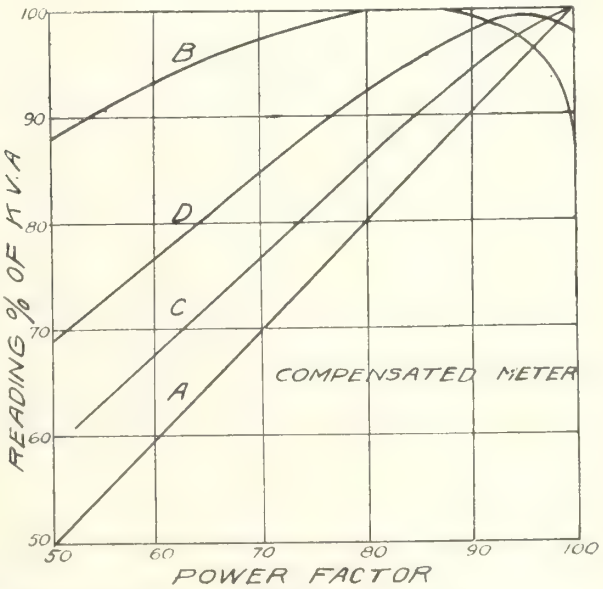


Fig. III. A—Curve for Accurate Meter.
B—Compensated to read 100% K.V.A. at 85% P.F.
C—Compensated to read 90% K.V.A. at 85% P.F.
D—Compensated to read 85% K.V.A. at 85% P.F.

and hence the power factor, may be determined by taking the ratio of 86.6 per cent. of the former to the latter reading, or again a curve may be constructed between ratio and power factor.

Instead of using the above factor of 86.6 per cent., there is no reason why the manufacturers of the various types of meters could not turn them out to read the wattless component directly. Indeed one of the larger manufacturers has already done this for one of the member companies.

Considerable care should be exercised in connecting up

[illegible] to obtain the correct indication. One method [illegible] to be successful is as follows:

Referring to Plate II, Fig. A. If the potential lead of element I is connected to phase C instead of A, the potential lead of element II is connected to phase A, instead of C, the middle wire being unchanged, while no changes are made to the current coils; if the meter was connected correctly at first, the indication under the revised connection will be zero. If it is not the current coils should be changed until a zero indication is obtained.

IV. A third method which is applicable to watthour meters and indicating watt meters, and which has been applied to an indicating watt meter by a German instrument company, consists essentially of overlagging the potential element of the meter, so that the angle between unity power-factor current, flux and the potential flux will be 90 plus an angle, say alpha instead of 90. This overlagging may be accomplished by inserting an external reactor in the potential circuit of the meter, or by using the compensating coils of the commercial type of meter, should a sufficient amount be obtainable for cases met in practice.

Assuming a contract power-factor of 85 per cent. as a basis to work upon, the ideal meter would be one which would indicate 85 per cent. of kv.a. for all values of power-factor. To approach this ideal condition, this method consists of artificially shifting the voltage coil current so that the indication will be a certain percentage of kv.a. at 85 per cent. power-factor, and so that the registration will be as near 85 per cent. of kv.a. as possible, at the actual operating power-factor.

With the meter compensated to read a certain percentage of kv.a. at 85 per cent. power-factor, the voltage vector will be turned through some angle, say ϕ, to effect the desired compensation; then the readings of the two elements of the polyphase meter will be as follows:

$$W_1 = VI \cos (30° + (\theta - \phi))$$
$$W_2 = VI \cos (30° - (\theta - \phi))$$

To illustrate the equations four curves have been plotted as per Plate III, in which different degrees of compensation have been chosen, which are shown in the table below:

Curve.	θ at 85% P. F.	Reading at 85% P. F.	Angle of Compensation
A	31° 48′	85% KVA	0°
B	31° 48′	100% "	31° 48′
C	31° 48′	90% "	6°
D	31° 48′	95% "	13° 36′

From a consideration of these curves it will be seen that with a 70 per cent. power-factor load, and with a meter compensated to read 95 per cent. kv.a. at 85 per cent power-factor, shown by Curve C., Plate III, the consumer would be charged actually 85 per cent of kv.a. and for variations in power-factor of 5 per cent. either way, the meter would register sufficiently accurate for all material purposes.

Upon examination of curve B, which is for a meter compensated to read 100 per cent. kv.a. at 85 per cent. power-factor, it is seen that the power-factor may vary from 70 per cent. to 95 per cent. without a result in error greater than 3 per cent. in volt-ampere measurement. Therefore, on consumers whose power-factor falls between these limits, it would be possible to install a meter with this compensation taking 85 per cent. of the readings as amount to be charged for, assuming, of course, contract power-factor to be of this value.

Plate IV. shows curves similar to those of Plate III., but drawn to show the rate of overcharge and undercharge at various power-factors for the different compensations. It should be noted in connection with this type of meter that for leading power-factor, there will be a deduction in registration, so that it should not be used unless a reduction in price per kw.h. for energy taken at leading power factors is justifiable. Also an inherent drawback of the compensated meter, as well as of the ordinary meter, is that, as the power-factor decreases the rate of under-charge decreases, a much less desirable arrangement than if the rate of undercharge decreased only when power-factors of more than contract amount were obtained.

Example.

One example of additional revenue to the central station from the application of penalty due to low power-factor may be cited. Power is sold to this consumer on a kilowatt-hour basis, and the load is a very closely balanced one, power-factor being determined from ratio of readings of two single-phase watthour meters.

Month	Average P.F.	Return due to low P.F.
Jan.	82.6%	$109.68
Feb.	79.5%	260.16
Mar.	78.5%	282.03
Apr.	83.1%	91.54
May	78.5%	338.64

Conclusion.

Summarizing, it may again be emphasized that the question of consumers' power factor is of vital importance to central stations in these days of increasing loads and costs, and all available means of bettering conditions should be rigorously investigated.

We have seen that, among others, four methods are available, the graphic power factor meter probably being of little use, and may be rejected. The single-phase meter method is cheap and simple, but assume balanced load, and also is of no use where power is sold on a maximum demand basis.

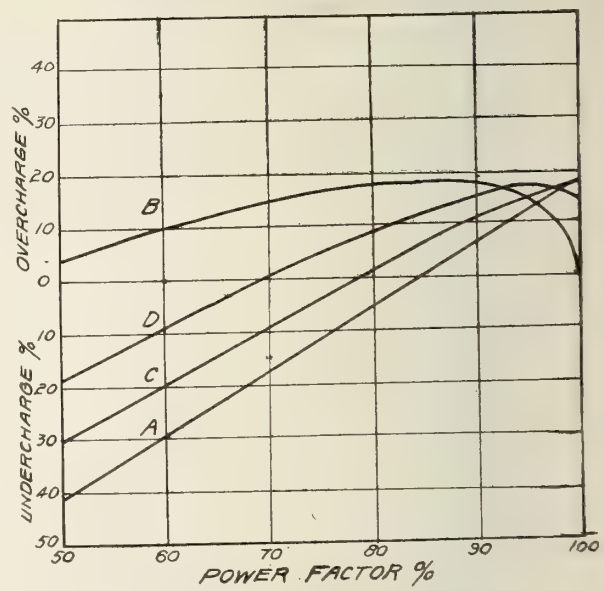


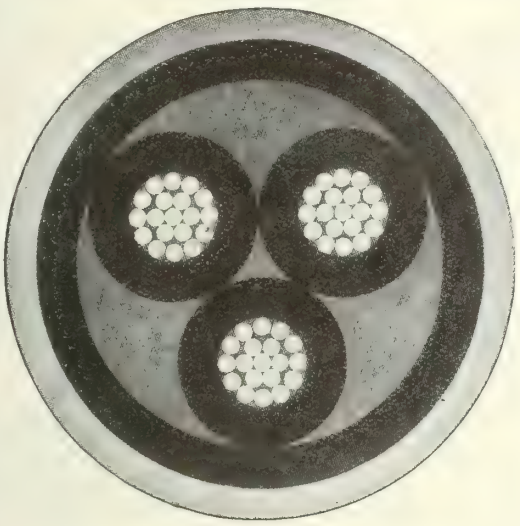
Plate IV. A—Curve for Accurate Meter.
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C—Compensated to read 90% K.V.A. at 85% P.F.
D—Compensated to read 95% K.V.A. at 85% P.F.

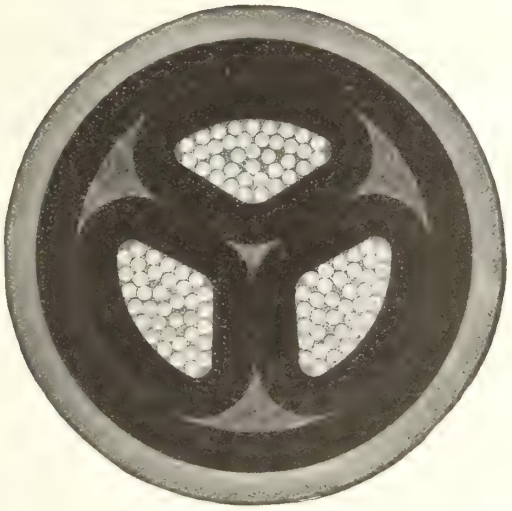
The third method of connecting standard wattmeters or watthour meters to register proportional to the wattless component would seem to be most preferable in cases of unbalanced load of widely varying factors, both for power sold on a maximum demand basis, or kilowatt hour basis.

The fourth method, the compensated meter, is applicable for load, the power-factor of which is fairly constant, and has the advantage of reading kilowatt-hours at contract power-factor directly, provided the meter with correct compensation can be taken.

PHILLIPS' CABLES

as supplied to the Toronto Hydro Electric System





These illustrations show cross sections in the original size of cables recently supplied to the T. H. E. System and reordered by them for further extensions. The specifications are as follows.—Conductors composed of 37 strands each, .082 in. diameter. Thickness of dielectric on each conductor, .210 in. Thickness in belt, .210 in. Thickness of lead sheath, .160 in. Overall diameter, 2.61 in., 250,000 C.M. Three Conductor, Paper Insulated, and plain Lead Covered Cable for 13,200 volts. We can supply you with wires and cables of any size for Power, Lighting, Telephone, Telegraph, etc.

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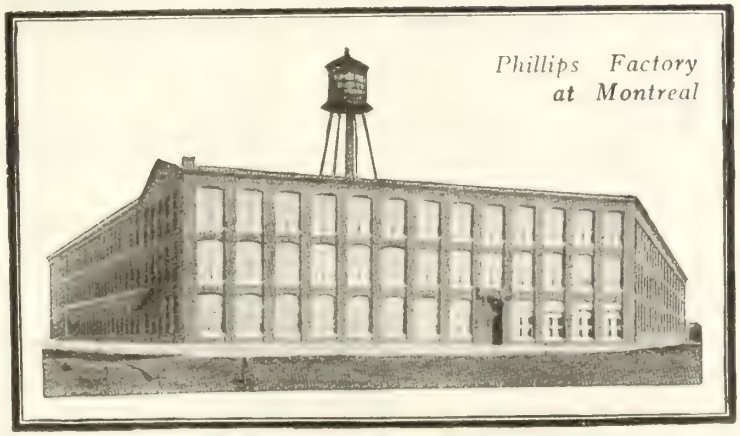
NOTE.—Specification of cable in left-hand cut: 3/0 B. and S. Three conductor. Each conductor 19 strands, each .094 in. diam. Thickness of dielectric on each conductor, .21 in. Thickness of dielectric on belt, .21 in. Thickness of lead sheath, .15 in. Overall diameter, 2.60.

Specification of cable in right-hand cut: As stated in copy.

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1 7½ H.P. C.G.E., Motor, 550 volts, 3 phase, 25 cycle, with compensator, no voltage release, reversible type.

1 5 H.P. C.G.E. Motor, 550 volt, 60 cycle, 3 phase type.

1 ½ H.P. Swiss Motor, 110 volt, 2 phase, 60 cycle, slip ring wound, sliding rails.

1 1 H.P. Westinghouse Motor, 220 volts, 2 phase, 60 cycle, with reel plate.

1 ½ H.P. Motor, 500 volt, D.C., slow variable speed, 275-350 R.P.M., with starting box and rheostat on slate slab.

The above can be bought right by users. The usual discount will be given jobbers.

Box 753, Electrical News, Toronto. 13-13

FOR SALE

1 Bellis & Morcom, Ltd., 145 KW. Vertical Compound patent self-lubricating steam engine, direct connected to

1 General Electric Co., Ltd. (London, Eng.) direct current compound wound Generator, 660 amp., 220 volts, speed 410 r.p.m.

and

1—Bellis & Morcom, Ltd., 375 KW., Vertical Compound patent self-lubricating engine, direct connected to—

1—General Electric Co., Ltd., direct current compound wound, interpole generator, 1500 amp., 250 volts, speed 350 r.p.m.

Immediate delivery.

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30 KW. Motor Generator, 50 h.p., 25 cycle, 550 volt, 3 phase motor, 230-250 volt, D.C. Generator, 720 r.p.m.

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3 125 K.V.A., O.I.S.C., Single Phase, 25 Cycle, Primary Voltage 24000/12000 V.
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1	100	3	25	550	750	Westg.
1	75	3	25	550	750	Westg.
1	50	3	60	550	850	Westg.
1	35	3	25	550	720	Westg.
1	25	3	60	2000	900	C. G. E.
2	25	3	25	550	750	Westg.
1	15	3	25	550	750	C. G. E.
1	7½	3	25	550	720	Westg.
2	4	3	25	550	1400	Excelsior
2	3	3	25	550	1400	Excelsior

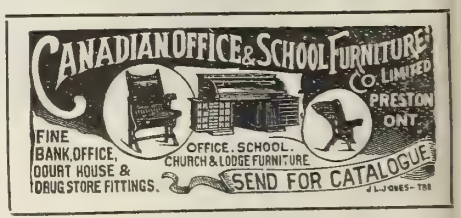
30 to 60 DAYS' DELIVERY

1	75	3	25	550	750	C. G. E.
1	35	3	25	550	750	C. G. E.
1	25	3	25	550	750	C. G. E.
3	10	3	25	550	750	Westg.
1	7½	3	25	550	750	C. G. E.
4	5	3	25	550	750	Westg.

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1	¼	R&M NEW.	110		1700
1	½	G.E. NEW..	110	KT	1800
1	½	G.E.	110	I	1800
5	1	G.E. NEW .	220	KT	1800
1	1	G.E.	220	KT	1800
1	1	Fbks. M. ...	440	B	1200
1	2	G.E.	220	KT	900
5	2	G.E. NEW .	220	KT	1800
5	3	Wstgh. New.	220	CS	1130
2	3	R&M NEW.	220		1150
3	3	G.E.	220	KT	1800
6	3	G.E. NEW .	220	KT	1200
1	3	G.E.	220	KT	900
3	3	G.E.	220	KT	1200
3	3	Cr. Wh.	220		1720
6	5	G.E. NEW .	220	KT	1800
3	5	Cr. Wh. ...	220	Q	1720
1	5	Cr. Wh. ...	550	Q	1720
1	5	Wstgh.	220	CCL	1700
9	5	Wstgh. New	220	CS	1735
1	5	Wstgh. New	220	CS	1130
53	7	G.E. (motors only)	550		1200
1	7½-15	Cr. Wh.	220/440		865/1735
2	7½	G.E. NEW .	220	KT	1800
1	7½	G.E. NEW .	220	KT	1200
6	7½	G.E. (motors only)	550	KT	1800
2	7½	G.E. NEW .	220	KT	900
2	10	G.E. NEW .	220	KT	1800
4	10	G.E. NEW .	220	KT	1200
1	10	Wstgh.	220	CCL	1700
1	10	Wstgh.	220	CS	1150
1	10	Cr. Wh. with resistance type starter	550	Q	1800
1	10	G.E.	220	L	1200
1	10	Robbins & M	220	K	1750
1	15	G. E.	220	I	900
1	15	Wstgh.	220		1155
2	15	G.E. NEW .	220	KT	900
2	15	Fbks. M.	220/440	KBV	1200
2	20	Wstgh.	220	CS	1160
1	20	Fbks. M.	220	B	1200
50	20	Fbks. M.	220/440	KBV	1200
19	25	Wagner.	220/440	BP	1120
2	30	Wagner New	220		850
1	35	G.E.	220	KT	600
1	35	Triumph.	220/440		900
1	40	Wagner NEW .	220/440	BP	850
1	40	Fbks. M.	220		900
1	35	G.E. NEW .	220	M	900
1	35	Westgh.	220		1170
1	40	Westgh. New	220	CS	870
1	50	Westgh.	220		860
1	50	Triumph	220		720
1	75	Westgh. New	440.	CS	720
1	100	Westgh.	440		1200
1	125	G.E.	220	L	600
1	150	G.E. NEW.	220	CW	695
1	150	G.E. NEW .	220	M	580

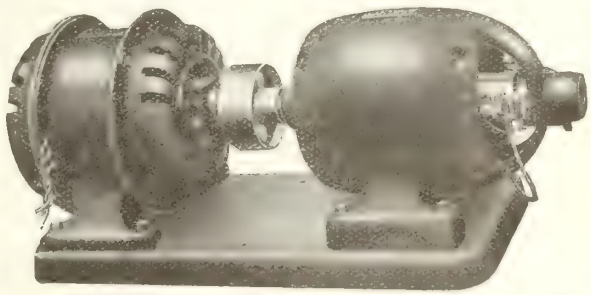
3 PHASE, 25 CYCLE MOTORS

7	2-5	Westgh. ...	220	CCL	705
1	12½	G.E.elev.type-high torque	220	KTE	750
6	15	Allis-Ch. ..	220		750
7	20	Allis-Ch. ..	220		750
1	20	G.E.	440	K	550
1	40	Wstgh. . .	220	MW	695
1	50	Allis-Ch. intermittent duty, sl. rg. drum controller	440		500
1	55	Wstgh.sl.rg. 30 cycles, complete. .	440		860
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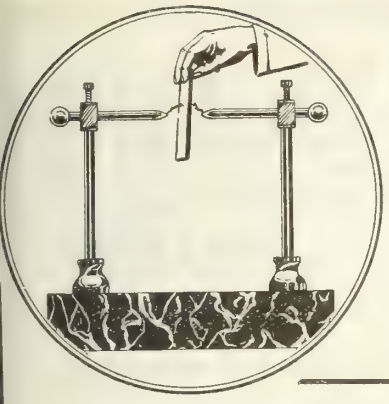
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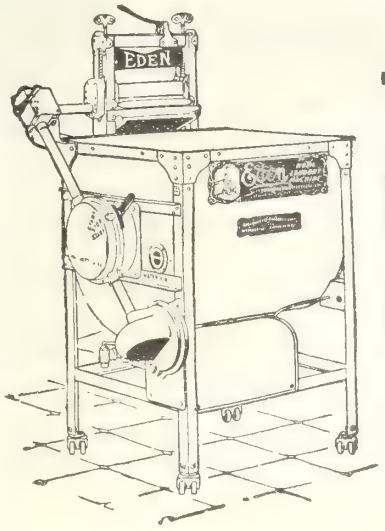
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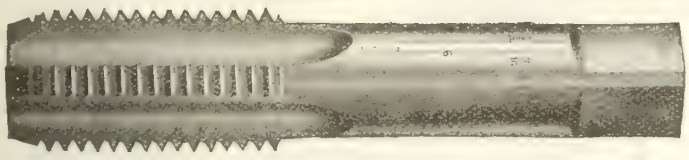
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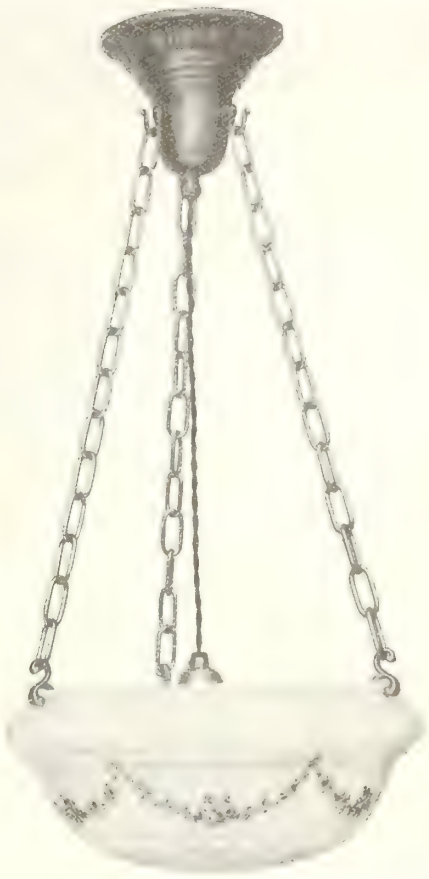
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Motors

3 PHASE—25 CYCLE

No.	H.P.	Make	Type	Volt	R.P.M.
1	1200	G. E.	I.P.	2080	250
2	750	West.		220	292
1	275	G. E.	Syn.	6600	275

3 PHASE—60 CYCLE

No.	H.P.	Make	Type	Volt	R.P.M.
1	1000	West.	H.F.	2200	360
1	300	G. E.	ATL	2300	225
1	300	A. C.	ANY	2200	505
3	250	Burke	Ind.	6600 2200	514
1	500	West.	C.S.	2200	1150

Transformers

25 CYCLE

3—375 K.V.A., 1 ph., 13200/6600-440/220 G. E.
3—100 K.V.A., 1 ph., 13200/6600-2200 G. E.

60 CYCLE

3—670 K.V.A., 1 ph., 2300 60-70 90-105 G. E.
12—250 K.V.A., 1 ph., 6600 2300 G. E.
3—150 K.V.A., 1 ph., 2300/76 Wagner.

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1—275 K.V.A., 25 cycle, 6600 volt, 275 R.P.M. G.E. complete.
1—400 K.V.A., 60 cycle, 480 volt, 600 R.P.M. G.E. complete.
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1—150 K.V.A., 60 cycle, 2200 volt, 900 R.P.M. Ft. Wagner.
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1—50 K.V.A., 60 cycle, 2200 volt, 1200 R.P.M. Westinghouse.

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1—300 KW., 600 volt, 160 R.P.M. Westinghouse Rly. Generator complete.
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1—150 KW., 550 volt, Type M, 575 R.P.M. Westinghouse Generator.
1—450 KW., 250 volt, Type M, 320 R.P.M. Westinghouse Generator.

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2—200 KW., 3 phase, 25 cycle, 600 volt, D.C., primary, 13200/1180 volt.
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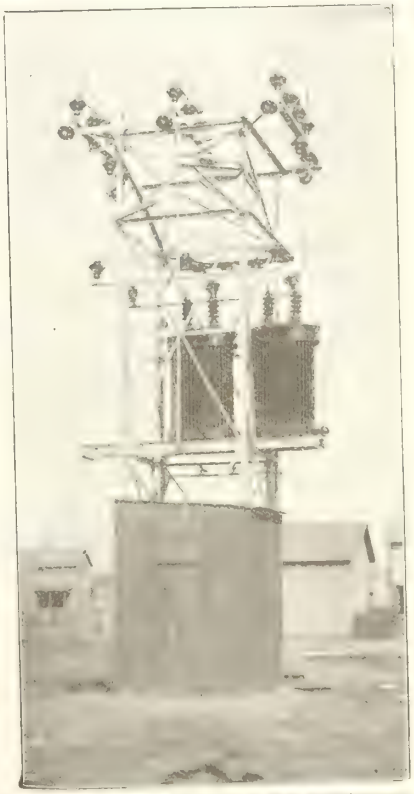
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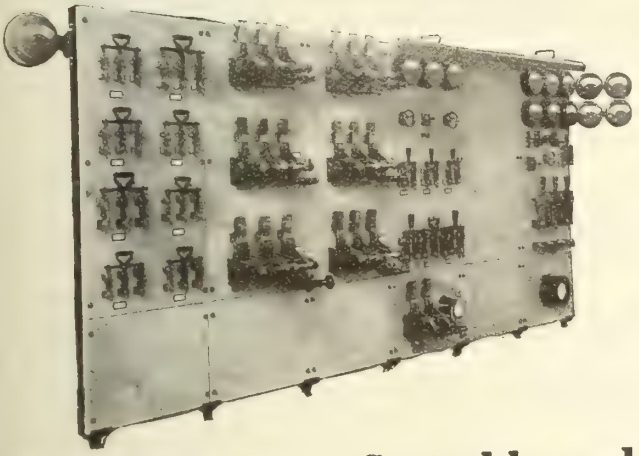
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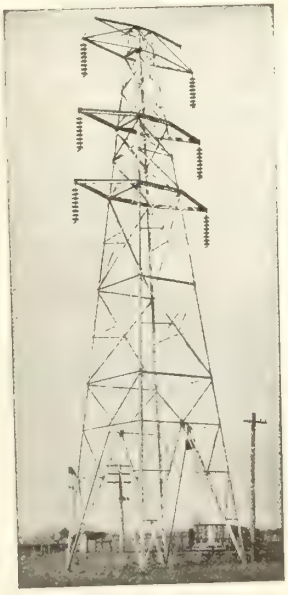
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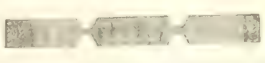
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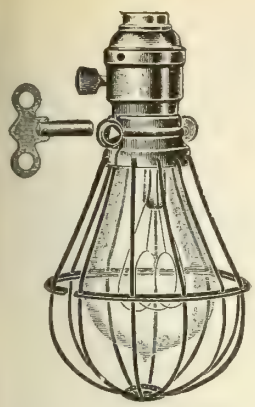
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(Continued on Page 64)



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One turn of the key and the lamp can't come out. Loxon, the lamp guard, is popular all over America. It sells at a single price at a single glance.

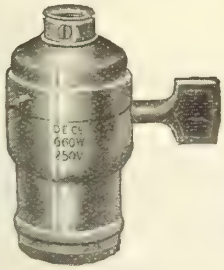
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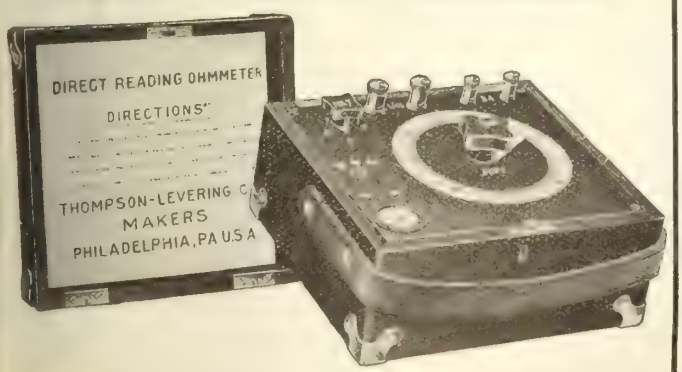
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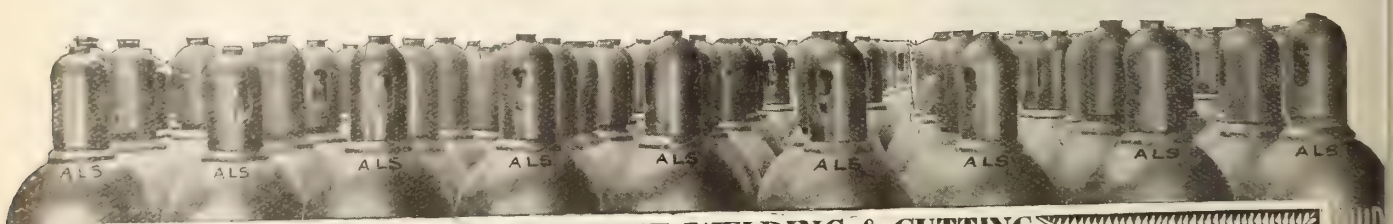
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Large Gear broken in centre and successfully welded

A National Necessity

The urgent necessity for the highest efficiency and a maximum production have forcibly demonstrated the value of the Oxy-Acetylene Process for all Industrial purposes involving the joining of metals and cutting wrought iron and steel.

As a means of conserving valuable material and the saving of Time, Labor and Money, its utilization is not only a question of efficiency and economy, but under existing circumstances is the performance of a National Duty.

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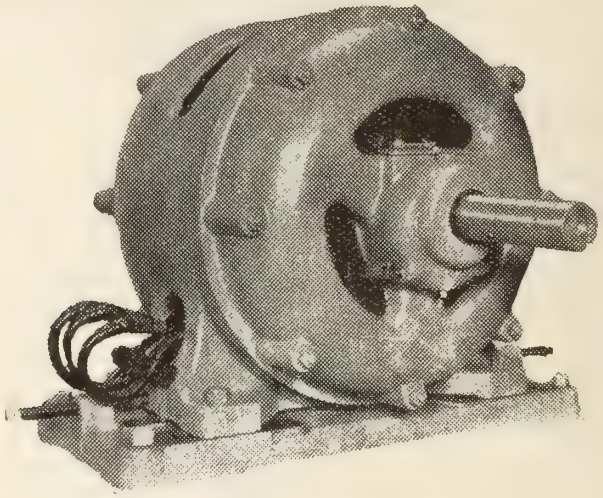
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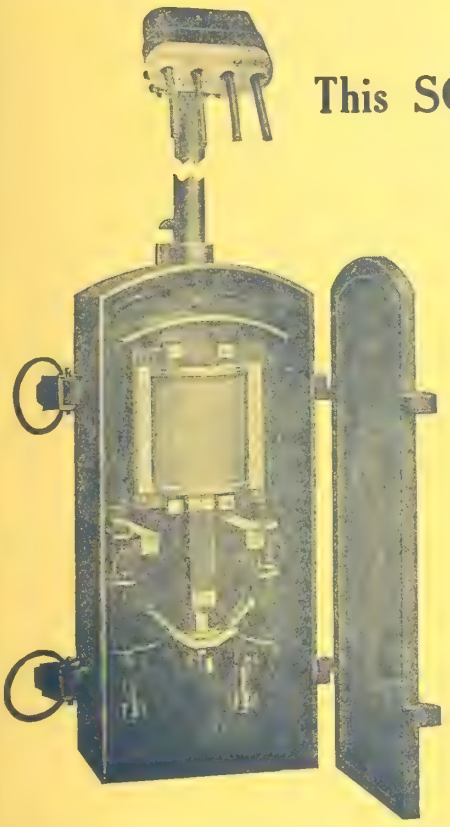


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Their reliability and efficiency have been demonstrated by exhaustive tests.

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This SOLENOID SWITCH has been adopted by the Hydro Electric Commission

They use it for

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Now the fact that it is used by the Hydro-Electric Commission is proof that it is all we claim for it. It certainly is not an experiment. by the fact that it is giving efficient service in many towns throughout Ontario, as well as the other provinces.

No springs, swivels or other complicated mechanisms to give trouble. They close magnetically and are opened by gravity assisted by the tension of the laminated copper contact. All arcing is taken up on the carbons.

Increase the efficiency of your system and decrease the cost of installation by using our Type 17 H.E.P. Solenoid Switches, which are suitable for any frequency on multiple circuit or D.C. Series circuit.

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are very carefully perfected

In the primary box illustrated, switch blade action is combined with bolted contact efficiency

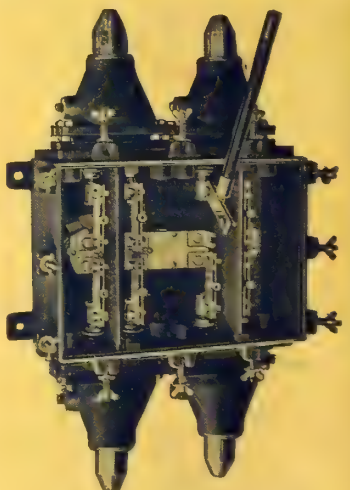
Unit cable potheads with ample compound space make an easy installation without sacrifice of safe, permanent cable end insulation.

The entire box is lined with insulating material—all bolt heads, etc., are coveréd and different polarities are thoroughly barriered.

In the secondary box double U clips give better contact alignment than would a single U clip.

The unit cable potheads attach at an angle, gaining roominess without using excessive wall space.

The line of this material is complete, offering constructions suitable for all conditions.



Primary Box for 2300 Volt Use

Let us quote you on your requirements

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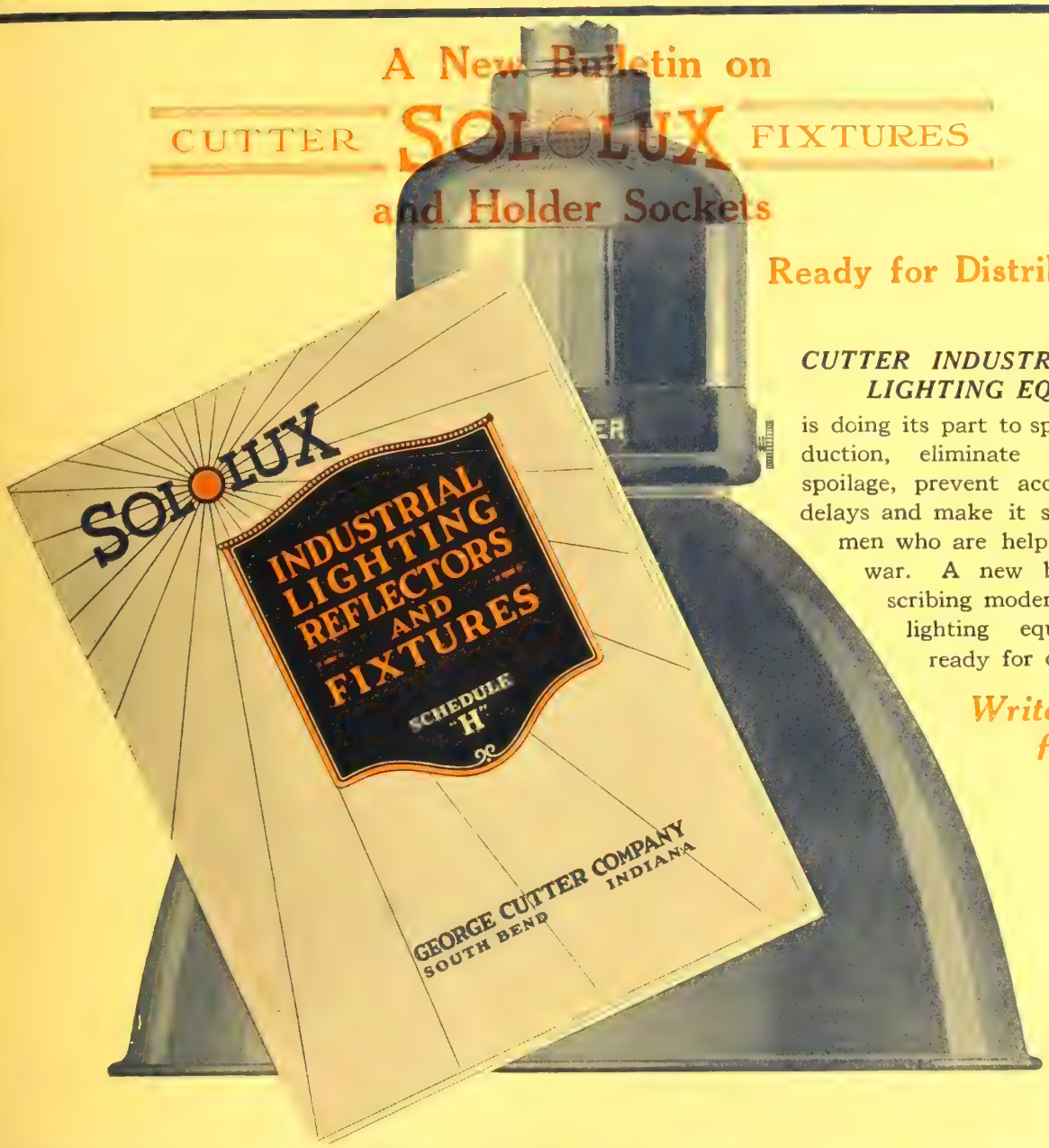
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Secondary Box for Low Tension Use

Electrical News
Generation, Transmission and Application of Electricity

A New Bulletin on
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SOUTH BEND, INDIANA
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Northern Electric
Household Utensils

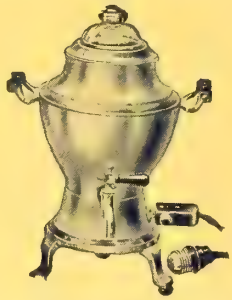
It is a known fact that electricity has done more than anything else towards the establishment of efficiency plus economy in the home.

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Coffee Percolator, Pot Style. No. 11793. Holds 7 cups or 2½ pints. Finished in nickel; comes with cord and attachment plug complete.



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Write our house nearest you for further particulars, literature and prices.

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B PRODUCTS
Quality First



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The picture shows a grade crossing with particularly hazardous possibilities—but it is protected by National Trolley Guard.

National Guard is a conductor in the form of an inverted trough of open wire mesh. If the trolley wheel leaves the wire the Guard catches it and furnishes current to carry car and passengers safely out of the danger zone.

National Guard is on duty at hundreds of crossings. After a company has once watched the first installation it usually protects the rest of its crossings with National Guard.

"Guarding the Grade Crossings" is a new booklet which describes National Guard and illustrates various installations. If you have not already received a copy, write to-day.

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The Excellence of the Products is Establishing the Line!

Write Now for Warm Weather Sales

PROFIT and PREMIER Electrical Appliances are linked together. Especially during warm weather days. For now is the time that the comfort and convenience of electricity appeal most strongly. And now is the time to cash in on the PREMIER advertising campaign.

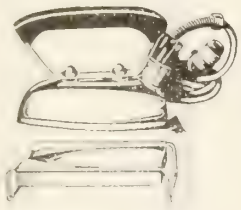
You'll find PREMIER appliances "all that the name implies," all that we claim for them, all that you would expect from this organization.

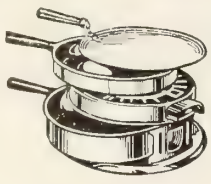
They are built by men who have grown up with the industry, men who are known throughout the trade for producing appliances of merit, for fair dealing, for progressive ideals.

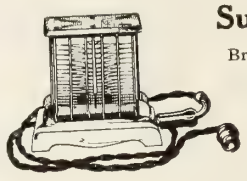
Few trades are harder to break into with a new line than the electrical appliance field. Yet, PREMIER distribution is coming faster even than we had hoped. That's because PREMIER appliances are sturdier, more handsome in design and finish, better value.

They carry a guarantee that has no strings or qualifications.

Test the PREMIER line now—while warm weather is stirring sales. Write for facts and figures, illustrated folders.







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Electrical Appliances

Fixture Catalogue

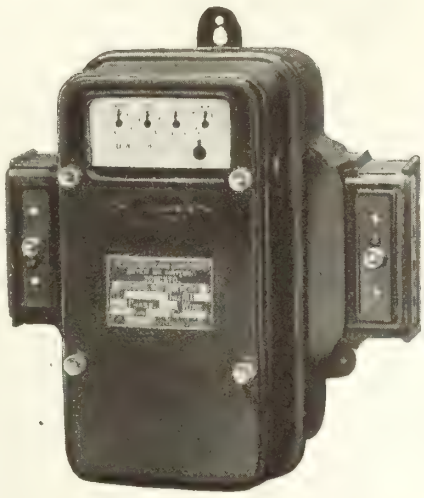


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Absorbs the Shock

Our special C. & H. Poly-Phase Meter is safe because it is fitted with new double terminal blocks that absorb the shock and reduce the danger of accident resulting from overloaded wires and from surge conditions during lightning storms.



This meter also has more inside room for the connections, and the three or four lines are carried straight through the meter from the left to right. In every respect this C. & H. Poly-Phase is a Safety Meter, and is undoubtedly the one to select for Installation on Long Distance Transmission.

C&H Poly-Phase The Safety Meter

The Company's guarantee goes with every instrument. The new Poly-Phase is as near perfect as it is possible for a meter to be.

Get Full Information
Write the Makers

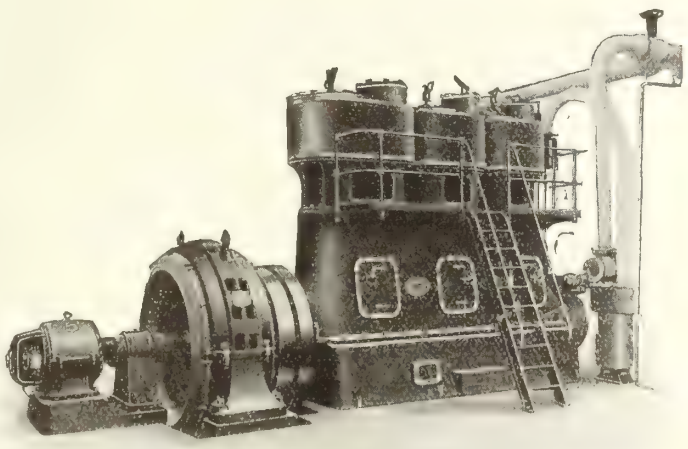
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The "Lancashire" Ball Bearing Induction Motor and "Patent Reversing Drive for Metal Planers," will repay investigation.

Descriptive matter sent on request.



Accidents will happen, but a complete stock of spare parts and well equipped repair shop ensure users of "Lancashire" machines, minimum inconvenience from such breakdowns.

750 K.V.A. Alternator direct coupled to engine.

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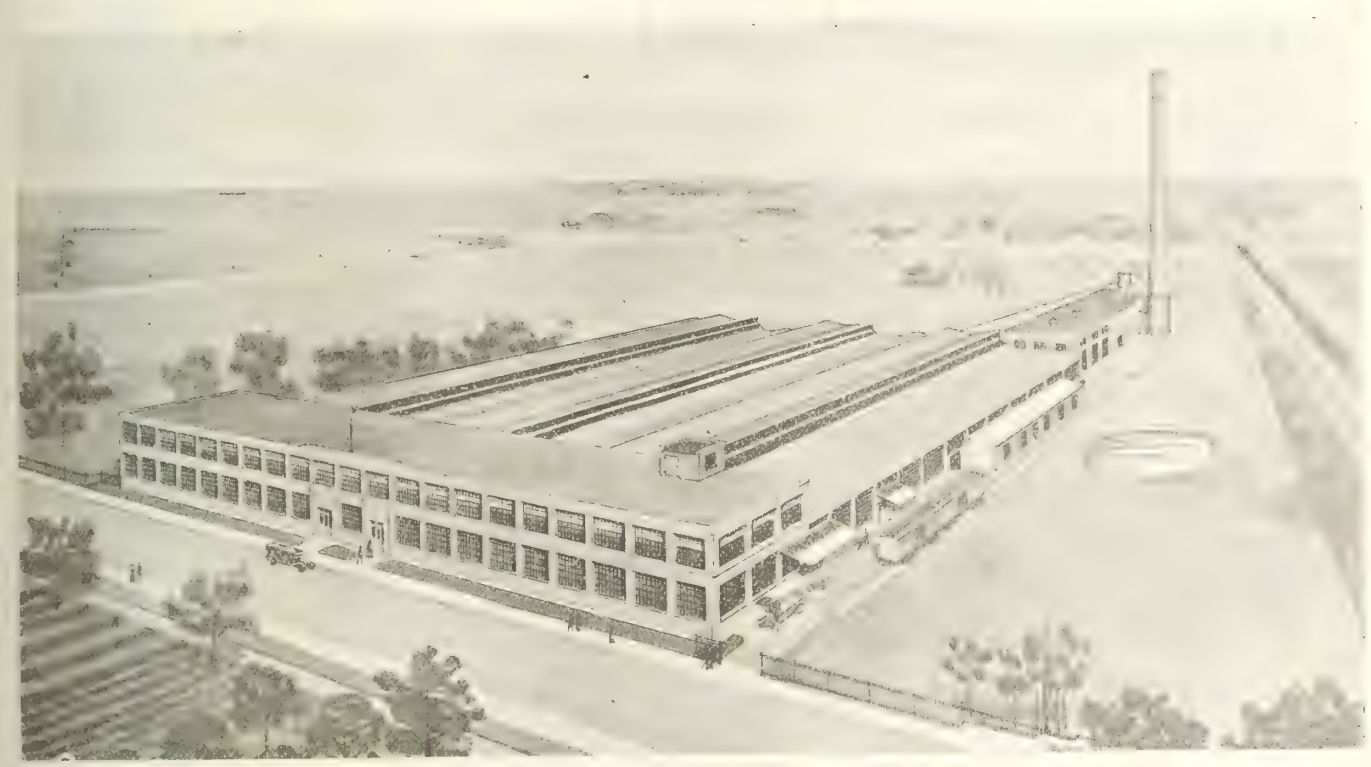
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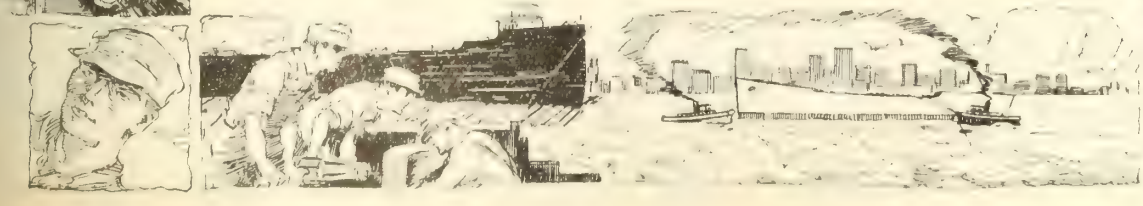
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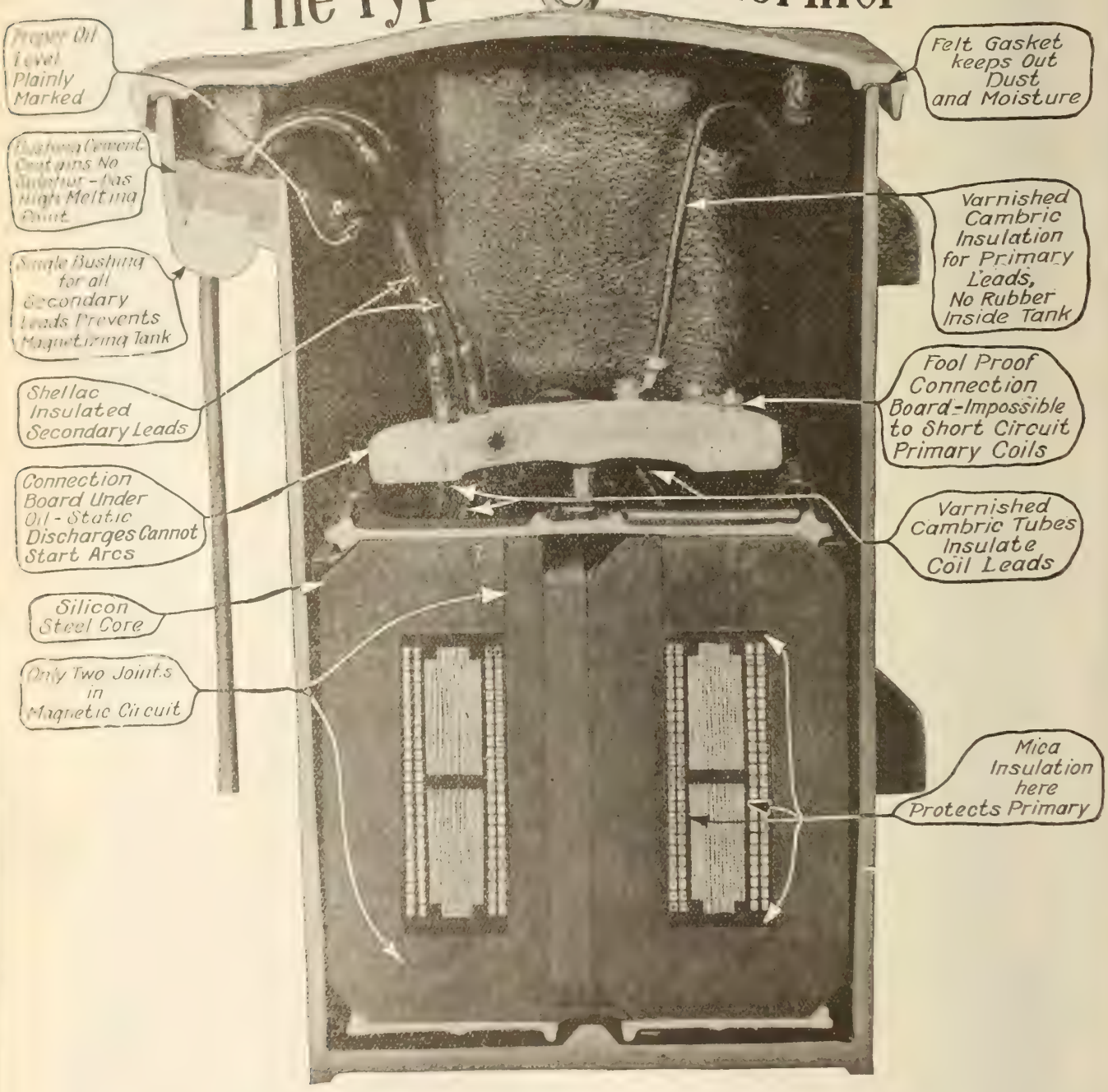
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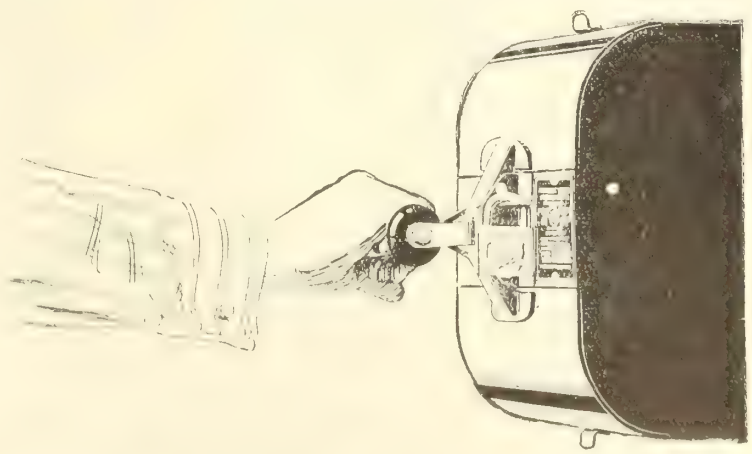
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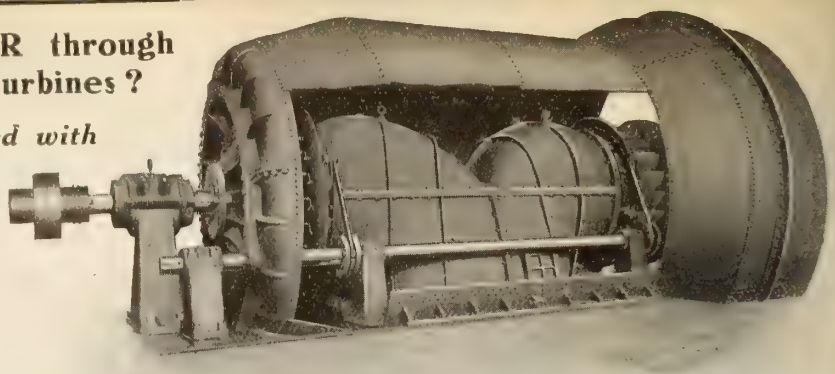
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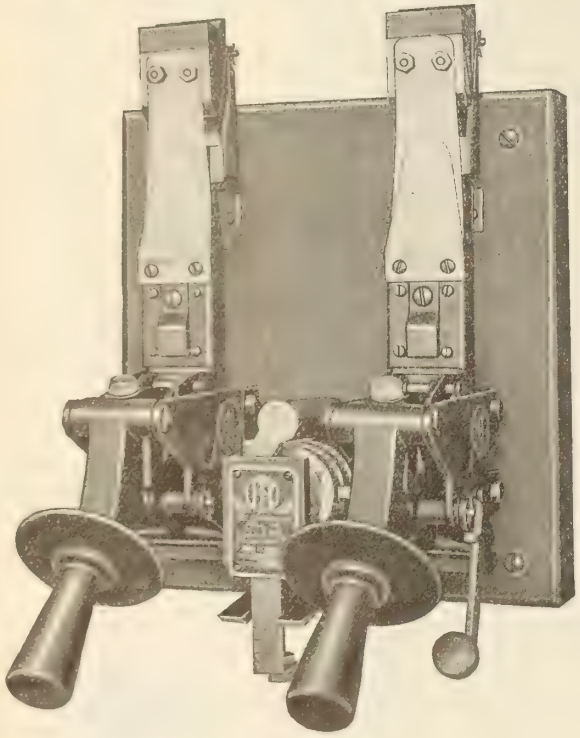
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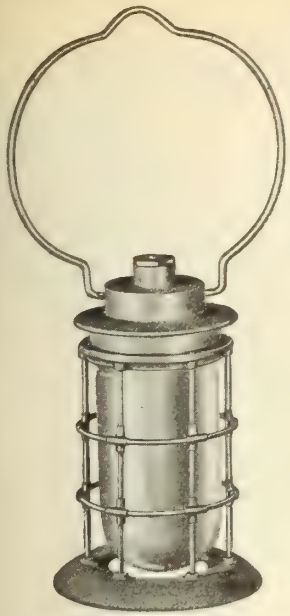
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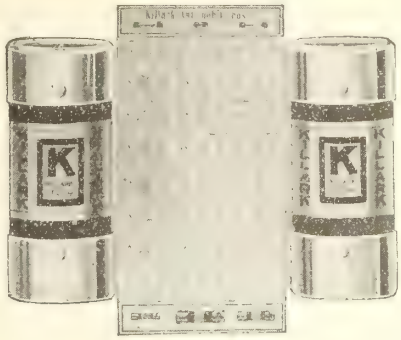
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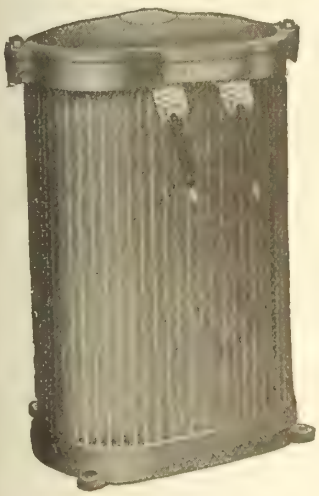
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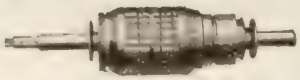
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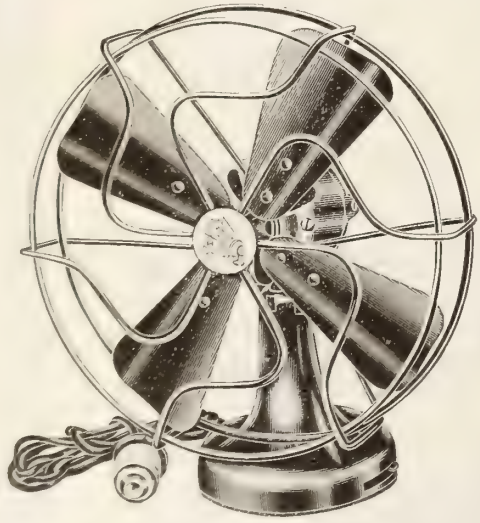
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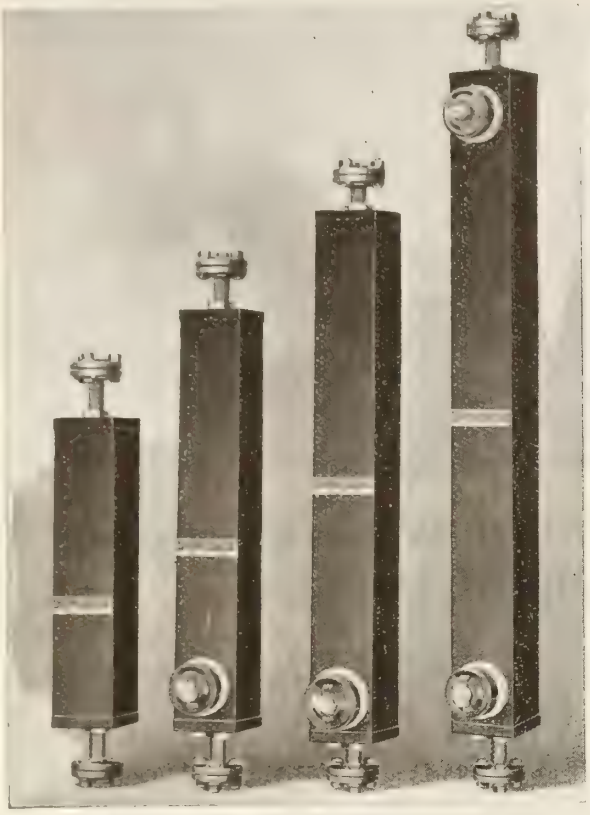
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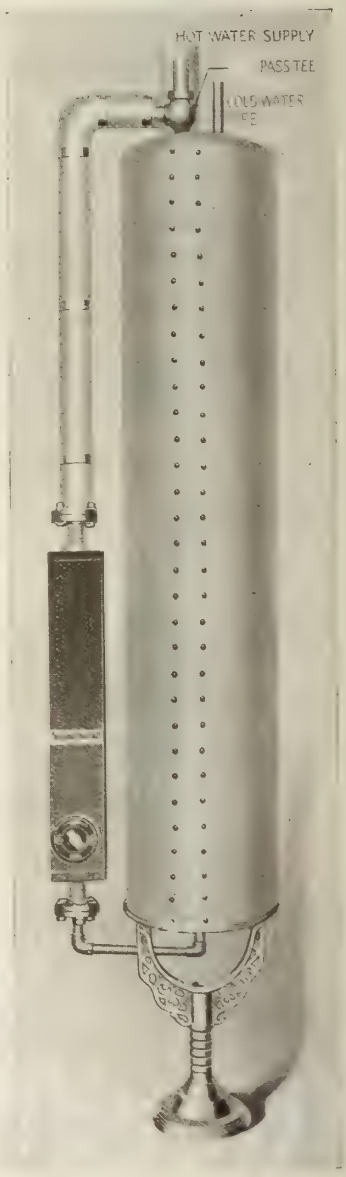
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Generation, Transmission and Application of Electricity

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Vol. 27 Toronto, July 15, 1918 No. 14

Fixation of Nitrogen Off-peak for Smaller Plants

The need of the present moment is explosives and of the immediate future, in Canada at least, is fertilizers. For both of these nitrogen, in one form or another, is essential, which seems to make the problem of the fixation of this element from the atmosphere one of the most important both present and future.

There are different methods of capturing nitrogren from the air, but the simplest is by the arc process. For this process a considerable amount of electric power is required and the cost of this form of energy has, in the past, been the chief obstacle in the way of its greater use in this industrial development. However, the present is no time to consider low cost as a first essential. The main thing would seem to be expediency and, for this reason, it would appear that the fixation of nitrogen by the arc process is not receiving the amount of attention it deserves. With the uncertain state of ocean transportation it surely is not wise to depend entirely on the Chile beds, which represent the main source of nitrates to the Allies, especially when there are coal and water resources in abundance lying idle which could be readily utilized, to say nothing of spare generating capacities at numerous Canadian points. Why not utilize these dormant powers to the discomfiture of the enemy, both during and after the war?

At the recent convention of the A.I.E.E., held in Atlantic City, Mr. E. K. Scott read a paper on "Electric Power for Nitrogen Fixation," in which the points in favor of the use of the arc process at numerous points throughout the country were forcibly presented. He explained the simple working of this prcess, the possibility of using it at off-peak hours without loss of efficiency, the advantages of establishing comparatively small plants at numerous favorable locations and the improvement in load-factor which would follow to the central station. The paper also points out that this process works in admirably with a coke-oven plant to produce ammonium nitrate. This latter suggestion may well prove a valuable lead to Canadian operators who have large areas of coking coal at their disposal. Extracts from this most interesting paper appear elsewhere in this issue.

Public Control with Private Operation

It is understood that General Manager Kidd, of the British Columbia Electric Railway Company, which supplies transportation, light and power to Vancouver and vicinity, is making an offer to the city council whereby the system shall be operated at cost, the company merely acting in the capacity of administrators—as Mr. Kidd puts it: "The citizens would control and the company would operate." The idea evidently is that the rates would be placed on a floating basis as is done in one or two cases in the United States. A schedule of rates is arranged which are temporarily on trial. If at the end of a pre-determined period there is just sufficient to cover operating expenses, reasonable interest on investment, depreciation and sinking fund charges, the rates stand for another similar period. If there is a deficit the rates are graded upwards; if a surplus, the grading is downwards.

Even the strongest advocates of municipal ownership should see much in favor of such an offer for, in effect, the only difference between that and municipal ownership in its purest form is that in one case the company receives the interest on the investment for distribution to the bond and shareholders, while in the other it is paid direct to the bondholders. Further, the arrangement of public control and private operation is a combination that is believed, by many students of the subject, to be the best solution of the present situation—it is the average between the two extremes. Excellent as the theory of municipalities owning their own utilities may be, there is no doubt whatever that it has been a fatal policy for many of our cities and towns throughout Canada, who, in their endeavor to avoid the evil of uncontrolled private ownership, fell into the trap of uncontrollable municipal ownership.

There is evidence, however, that all over Canada, having now had experience with both evils, we are sitting back and taking a survey of the whole situation with a view to effecting a compromise that will include as many as possible of the good points and as few as possible of the bad points of the two tried systems. Mr. Kidd's offer to the Vancouver municipality seems to be coming pretty near the mark.

Electric Truck Operating Costs Data

In selecting transportation equipment, sentiment, likes and dislikes, fancied or otherwise, should play a very small, if any, part. Transportation engineering—for transportation is an engineering problem, and should be approached like any other science—should be applied, particularly if most economical and efficient results are to be realized.

In the final analysis, the real test of a truck's value is its service record for a period of time sufficiently long to meet both good and bad conditions. A single, one-day demon-

stration under ideal conditions is not broad enough. It should take at least a month of steady work to prove the real qualities of a truck, and bring out all its weak points, if any.

Following is a record of a 750 lb. electric truck used in ordinary city deliveries for thirty working days. Compare with horse drawn and gasoline truck costs to fully appreciate its true value

Days operated		30
Miles traveled		1140.5
Kilowatt hours used		319.5
Number of miles per kilowatt hour		3.57
Greatest current consumption for 1 day	kw.h.	13.
Smallest current consumption for 1 day	kw.h.	10.
Average current consumption for 1 day	kw.h.	10.65
Shortest run	miles	33.5
Longest run	miles	46.5
Average run	miles	38.01
Greatest merchandise load (overload of 750 lbs.)	lbs.	1,500
Smallest merchandise load	lbs.	500
Average merchandise load (overload of 250 lbs.)	lbs.	1,000
Current cost per car mile at 3c per kw.h.		$.008
Current cost per car mile at 4c per kw.h.		.011
Current cost per car mile at 5c per kw.h.		.014
Maintenance (maximum estimate) including repairs and renewal of all mechanical and electrical parts, including tires, battery, and painting of wagon should not exceed, per car mile		.04

Power Situation in Great Britain to be Under Control of Five Commissioners

Troublesome as the power situation has been at certain points in Canada it is easily understood that in the British Isles, where the demand has been so much greater and more insistent and where, besides, there are few large water-powers, the need for conservation has been much greater. Conditions governing operation are different, too, in England, in that there are very few long-distance transmission lines, each small centre operating its own plant by coal, and as the result of this absence of interconnection, it is not possible to utilize excess power which may be lying idle in one town for manufacturing purposes in another town. Also, as often happens with old steam plants, no doubt just as it is in Canada, the efficiencies become very low and much more coal is consumed than should be allowed.

In order that a careful study may be made of the power situation in England and some constructive recommendations based upon the results of these studies offered in solution, the British Board of Trade recently appointed an Electric Power Supply Committee "to consider and report what steps should be taken, whether by legislation or otherwise, to insure that there shall be an adequate and economical supply of electric power for all classes of consumers in the United Kingdom, particularly industries which depend upon a cheap supply of power for their development." Representative associations throughout the country were invited to give evidence and the Committee has now brought in a recommendation that five electrical commissioners should be given complete control, one commissioner to each of five districts, and that the existing system under which electricity is separately generated for small areas should be abolished, utilizing larger units from which the various municipalities should buy their power. Briefly, the recommendations may be summarized as follows:

(a) That a new body, to be called the Electricity Commissioners, should be set up, to whom should be transferred the existing powers of the Board of Trade, Local Government Board, local Government Board for Ireland, and Scottish Office, relating to the supply of electricity, and to whom large additional powers should be given for regulating and encouraging the generation and distribution of electricity.

(b) That the Electricity Commissioners should, subject to an appeal to Parliament in certain cases, have general control over the generation and distribution of electricity in the United Kingdom.

(c) That the existing system under which electricity is separately generated for small areas should be abolished.

(d) That the Electricity Commissioners should; after local inquiries, divide the United Kingdom into districts technically suitable for the economical generation and distribution of electricity.

(e) That in each electrical district a District Electricity Board should be set up which should purchase all generating stations of authorized distributors, whether local authorities, companies, or power companies.

(f) That the District Electricity Board should be responsible, by themselves or their lessees, for the future generation of electricity in their district and for the establishment of new generating stations and proper systems for the main transmission of electricity in their district.

(g) That existing electrical undertakers should, if they so desire, retain their power of distributing electricity within their local areas, but should purchase electricity in bulk from the District Electricity Boards or their lessees, due provisions being made for controlling the profits of of distributors so as to ensure a cheap supply of electricity to consumers.

(h) That District Electricity Boards should make no divisible profits.

(i) That District Electricity Boards should be financed, in whole or in part, by funds raised with government assistance, except where it is shown to be desirable and practicable to finance the boards locally.

(j) That largely extended powers should be granted for, inter alia: (a) The use of overhead wires: (b) wayleaves; (c) acquisition of water rights.

Daylight Saving in Canada Has Not Had Revolutionary Effects

Central stations everywhere in Canada viewed with some trepidation the introduction of the daylight-saving scheme. Being an entirely new departure here they were unable to form any reasonable judgment as to its probable effect on the load factor or the revenue. However, we have now had an experience covering over two months and, for the most part, we can say that nothing very much out of the ordinary has happened. Recently, with a view to gathering the results of experiences to date, we addressed enquiries to a number of the prominent private and municipal operating organizations asking what noticeable effect the change had made on their load factor. From a large list of replies it would appear that no very great loss in revenue has been sustained nor is there, in general, any appreciable change in the load curves. Perhaps under normal conditions the effect would have been more evident, but owing to war business, the load in the majority of cases has not only been greatly increased, but also has entirely changed in its characteristics so that it is impossible to compare, say, June of 1918 with the corresponding month in 1917—about the only reasonable basis of comparison. The replies, however, are interesting from an operating standpoint, and we quote a number of extracts from the letters received:

1. We cannot trace any great change in our load curves. On the other hand, we certainly notice it on our financial statement. It is my opinion that daylight saving will affect the lighting-revenue from 15 per cent. to 20 per cent., and we

will need to sell lots of irons and apparatus to coax the elusive dollar.

2. On account of the short time during which daylight-saving has been in operation, it has not yet been possible to analyse the effect of this change of time.

3. In so far as our plant is concerned it is somewhat difficult to determine with a fair degree of accuracy to what extent daylight saving reduces the load factor.

In the first place, it is difficult to make a comparison of our load curves of last month with those of the same month a year ago as the load conditions have undergone value. A comparison of the curves for the first month that daylight saving was in force with those of the month previous is also of little value, because the change in load conditions at that period of the year are so rapid that little information would result from this comparison. However, we find by taking the totality of kw. hours supplied for lighting purposes for February and March that they are practically the same as the kw. hours supplied for the same months a year ago. On making the same comparison for May we find a reduction of approximately 32 per cent. This 32 per cent., I believe, represents approximately the effect of daylight saving on the current supplied for lighting purposes.

4. Our lighting load and any load that would be affected by daylight saving is so small in comparison to our other load that daylight saving has no affect on the load factor of our station.

5. We are unable to supply this information with any degree of accuracy owing to the fact that while our lighting load shows a falling off this is more than offset by the gain in power sales, so that there is but a very slight change in our load factor. It is also a difficult matter to make comparisons from revenue because our rates for electric light and power now in force are considerably lower than the rates prevailing during the corresponding period last year.

6. The "daylight-saving" is noticed very little in our plant. The reason for such would be that the streets are lighted by natural gas, all the houses are piped for natural gas and have been for years before the electric light plant was installed. With natural gas at 15c per 1,000 cubic feet, and electricity at 6c per kw.h., long hours of daylight in Western Canada, puts us in a position that the extra lighting load could scarcely be read at our switch board.

7. It is a very difficult matter for us at the present time to determine what the effect on the load factor has been, owing to the abnormal demand for power for munition purposes. We are looking over our station records endeavoring to segregate the purely residential districts from the others, with a view to obtaining the load factor on these circuits before and after the new bill came into operation.

If the information thus obtained furnishes any data of interest we will be pleased to forward it to you, but, as stated above, we are unable to determine what effect the new bill has had on the load factor of the total system, due to the increase at the present season in the demand for power for munition purposes.

8. We are unable to find that it has had any effect whatever upon our load factor.

9. We are not in a position to compare our load curves as to effect of "daylight-saving," owing to the variation on power load.

10. On acount of the load being so much under control, due to the shortage of power, our charts do not show the saving due to the change in the clocks.

11. We have pleasure in enclosing typical lighting curve, which we believe will give you the information you require for your article. As noted on the curve, the lighting load increased 10.5 per cent., but the peak is reduced 8.3 per cent., which demonstrates the effect of "daylight saving".

12. Our load is largely a power one and as yet we can notice very little difference. In fact we are all very much pleased with the "Daylight Saving" and would like to see it carried right through the year. We believe in the fall of the year it would reduce, if not wipe out altogether, the severe overlap of light and power between 5 and 6 p.m. If we could be relieved of this overlap we think that it would more than compensate us for any reduction in the demand for light.

What Will Become of Canada's So-called Industrial "Prosperity" When the Orders for War Materials Stop Coming?

It has been said that Canada's industrial condition today is better described as "active" than as "prosperous." That is to say, a business which is more or less temporary, as this war business must be, does not represent a real stability and prosperity as we interpret this term in normal times. This condition may last five years or it may only last as many months and it is nothing more than common, everyday horse-sense to ask ourselves what will happen, industrially, when the war is over.

Statistics show that Canadian exports in 1917 exceeded those in 1913, the last year before the war, by something over one billion dollars. This was made up roughly of 40 per cent. agricultural and 60 per cent. manufactured products. It may reasonably be argued that the 40 per cent. of agricultural export will still be required after the war, and much more, but the same is not true of the 60 per cent. made up of manufacturers. It is plainly an urgent question then as to how our manufacturers are going to weather the inevitable slump. There will be ample labor, ample raw material and, to all appearances, ample capital, but where will the orders come from?

Our captains of industry are not indifferent to these conditions and have a worthy leader in Senator Frederic Nicholls, president and managing director of the Canadian General Electric Company, who has repeatedly raised his voice in warning during the past two years that we must be prepared for the future. Senator Nicholls has championed the cause of the manufacturers in the Canadian Senate where it is safe to say his forceful and unanswerable arguments on international trade questions have made him the outstanding figure of the past two sessions. Nor has he been satisfied to rest the matter there. Before meetings of the Manufacturers' Association and in the financial and technical press he has advanced telling arguments in favor of a definite, thoroughly organized plan of co-operation between the manufacturers and the government, to the end that the export trade of the Dominion may not suffer with the cessation of war orders.

Senator Nicholls makes a strong point when he calls attention to the recognized adaptability of the Canadian manufacturer to new conditions. He recalls that very high officials in the British War Office stated that Canada had shown greater adaptability in the matter of munition manufacture than even the Motherland. He naturally concludes that there should, therefore, be no sound reason why we cannot adjust ourselves, to whatever extent it may be necessary, to after-war conditions.

Senator Nicholls is now addressing himself to the general press of the country and asking for co-operation. During the past few days, letters, of which a copy is reproduced below, have been sent out to the newspapers and there is little doubt they will give it their hearty support. In years to come when Canadian manufactured products shall have become as commonly known the world over as were German products before the war, it will not be forgotten that the success

largely due to the courage and persistent energy of this man who has never lost confidence in the ultimate triumph of Canada as a great export manufacturing world power.

Senator Nicholls' Letter.

212 King Street West, Toronto,
June 21, 1918.

Dear Sir,

I venture to direct your attention to a matter in which the newspapers may render a great public service.

At present this country is exceedingly prosperous by reason of the balance of trade which is so greatly in our favor. When the war is over, and our exports of munitions and war materials to the value of over a billion dollars yearly shall have ceased, we will be left with huge financial obligations the cost of our share of war expenditure, and unless we prepare and are ready to meet the changed conditions, we will be face to face with the most serious financial situation that Canada has yet experienced.

The responsibility of sounding a note of warning and also a call for action lies with the newspapers of Canada, which are the educators of the public in regard to conditions as they may arise, and I submit that next to winning the war the most important problem before the Canadian public is the question of preparedness for adverse conditions that must arise following the conclusion of the war.

The interest and sinking fund charge per capita on our national debt has increased from $1.70 to 1913 to $10.00 at present, or over five hundred per cent. in four years, and is still increasing, and the Reconstruction Committee of the Federal Cabinet should be urged to initiate some policy designed to offset the shrinkage of exports of agricultural, manufactured and natural products which will most certainly diminish as soon as the war ends.

The farmer, the lumberman, the manufacturer, the miner, the financier, the mechanic and the laborer, in fact every class of the community, are directly concerned, and the press of the country can render great public service in urging the importance of preparedness and the mobilization of our national resources in an efficient manner.

I enclose herewith some facts and figures* which have been carefully compiled.

Yours faithfully,
Frederic Nicholls.

*Pamphlet containing reprints of addresses and discussions on this subject in the Canadian Senate, and articles written by Senator Nicholls for the Technical Press.

Annual Meeting Montreal L. H. & P. Co.

The gross revenue of the Montreal Light, Heat & Power Consolidated for the past year was the largest in the history of the company, said Sir H. S. Holt, at the annual meeting on June 5. This was due in part to the demand for power by the munitions companies and also to the high prices received for by-products. There was no reason to look for any slackening of this demand for electrical energy as plants formerly engaged in munition work were already taking up other lines of business and continuing with electric power.

As to the amount written off for depreciation, the president explained that this was necessary, and stated that no company in Canada, and but few in the United States, provided so liberally for depreciation as did their company. Old engines that were in use a few years ago have been thrown aside for more economical ones.

The demand for power had necessitated the installation of two new units at Cedars, which would be in operation by September.

The price of gas and electricity in Montreal was the lowest in America, but if materials and taxes continued to advance, the company would be forced to increase the cost of the commodities it sold.

Winnipeg Municipal Electric Display

At the recent convention of the Retail Merchants Association, held in Winnipeg, the Municipal Light and Power Department had an attractive display. The decorations of the exhibit were white trellis woodwork, back and sides covered with creeping nasturtiums, the whole effect being light and attractive to the eye. An interesting contrast was shown between the old and modern methods of cooking by an electric range in the centre with a coal range and a gas range on either side of it. The former had a display of coal, wood and ashes ticketed up "Coal to carry," "Wood to Chop," "Ashes to clear away." On the gas range there was the following show card:

YOUR MONTHLY GAS BILL!
WILL YOU LET ELECTRICITY CUT IT IN HALF?

A few examples of how electricity has saved money for other citizens of Winnipeg—why not you?

	Monthly Gas Bill	Monthly Electric Bill
Mr. Frank Wiley, 64 Middlegate....	$10.00	$4.50
Mr. F. K. Herchmer, 986 Grosvenor..	9.00	3.08
Dr. Christie, 150 Canora	8.00	2.50
Dr. Fletcher, 220 Elm	5.85	1.76
Mr. J. Swan, 605 Alfred Ave.	3.50	1.60

This card gave the salesman a strong talking point. They also had a display of other electric cooking ranges, heaters, water heaters, show cards, etc. The visiting merchants, as well as the general public, were much interested in the display, and the management are confident the exhibit will prove a beneficial advertisement for future business. The exhibit was in charge of Mr. R. A. Sara, sales manager.

Promotion by Merit

Our Union Government has given evidence of their sincerity regarding the abolition of the patronage system in the promotion of Mr. W. E. Lemon to the City of Toronto postmastership. It is true Mr. Lemon is eminently fitted for the post, but this, in the past, has not been considered sufficient qualification when in competition with importune politicians who have had to be provided for. It is to be hoped the old system has gone forever. Without doubt the appointment of Mr. Lemon will have a beneficial effect throughout the Canadian Civil Service, the members of which will see in it a recognition of the principle that merit and devotion to duty are to be determining factors in selecting men for positions of greater trust.

Prize for Paper on Co-ordination of Research in Works and Laboratories

The Council of the Institution of Electrical Engineers are prepared to receive papers on the subject of "The Co-ordination of Research in Works and Laboratories," with a view to the paper being read and discussed at one of the ordinary meetings of the Institute in London and also before one or more of the local sections.

Papers should not exceed 15,000 to 20,000 words in length, and the Council are prepared to award a special premium of £25 to the author of the paper which in their judgment best fulfills the objects of the discussion, provided such paper reaches the standard aimed at by the Council.

Papers should be sent to the secretary of the Institution not later than the 4th November, 1918. It is the intention of the Council to publish the selected paper (which will become the property of the institution) in the Journal, together with the discussion. Competitors intending to submit papers are invited to communicate with the secretary.

Electric Power for Nitrogen Fixation

Production by Arc Process Has Merit of Simplicity and Low Cost for Fquipment—Off-peak Output of Small Plants May be Utilized

By E. Kilburn Scott*

One of the most powerful combinations in the world is that connected with the exploitation of Chile nitrates, and to extend the uses of that material and regulate prices, etc., there is a Chile Nitrate Committee supported by the various interests concerned.

It was created for propaganda work amongst farmers and others, to facilitate the use of nitrate as a fertilizer but since the advent of air nitrates some attention has been given to discrediting the methods of fixing nitrogen from air. This has been done partly by paragraphs in the press throwing doubt on the financial and technical success of such methods, etc. German influence, working through political clubs and the press, also assisted the Chile nitrate propaganda while at the same time German scientists were being assisted in every possible way to develop air nitrate processes in their own country.

Years before the war, some of us saw the question of supplies of Chile nitrate for the manufacture of explosives would be an important factor, and in 1911, at the Portsmouth meeting of the British Association, and later at a meeting of the Society of Arts in London, I sounded a note of warning.

To show how different the Germans tackle these matters, I may say that when the war started, the German government appointed an electrical engineer, head of the Allgemeine Elektricitats Gesellschaft, to expedite the manufacture of explosives.

On the other hand when the British government started its explosives department a lawyer politician was put in charge, and even afterwards, when a Minister of Munitions was appointed he also was a lawyer politician and had as second in command, a doctor of medicine.

The appointment of politico-legal persons to positions concerned with scientific and engineering matters, has been favorable to Chile nitrate and to German propaganda, in that it retarded developments that would have assisted to make the Allies independent of Chilean supplies.

Even after three and a half years of war, the Allies still remain practically dependent for explosives on supplies which have to be brought thousands of miles. This requires much shipping that might be used for other purposes and also occupies the attention of part of the Navy, in order to keep open the sea routes.

It is to their credit that certain scientists and engineers of this country not only saw the danger, but insisted on the authorities taking action by providing money to establish plants for the manufacture of nitrates.

At the same time, in this country as well as in England, there has been time lost, owing to certain parties manoeuvring to obtain the adoption of their own process to the exclusion of others. In so large a field as nitrogen fixation there must necessarily arise numerous improvements in the various processes so that it is not possible to-day for anyone to gauge or forecast their future relative economic values.

This is particularly the case with processes in which electrical energy plays a leading part for it is a sort of ingrained habit of the electrical engineer to simplify and revolutionize existing methods that they eventually become essentially electrical. The whole history of electrical progress, and especially of electro-chemistry and metallurgy establishes that fact.

I consider that boards or committees dealing with nitrate problems should be largely made up of engineers who have expert first hand knowledge of electrical power conditions and of appartus, etc. Chemists, pure and simple, are useful but they should not have power to pass upon processes in a field which electrical engineering is capturing so completely as the production of nitrates.

In certain quarters there has been too great a readiness to listen to the tittle tattle of propaganda such as hinted of above.

I feel that the merits of the arc flame process for making nitric acid have not been adequately and sympathetically considered, and this paper is written with the special object of stating them. I wish also to remove the misconception that the arc flame process is dependent on water power and that it can only be installed economically on a very large scale. The matter is one of special interest to electrical engineers because the process is essentially an electrical one.

Electric Power.

As a basic load for a power house the direct arc process presents the advantage that it can be established anywhere, because the raw materials being only air and water, considerations of transportation do not enter into the situation.

It is particularly suitable for off-peak or off-season loads, for there is no fused material to solidify, and little to deteriorate in case of stoppage. Some of the furnaces can be switched on and off like an arc lamp, without detriment to brickwork or structural details, or to the process of manufacture.

As there seems to be some doubt as to the possibility of running arc furnaces intermittently on a commercial scale, I would mention that about seven years ago a nitric acid factory was built at Legnano, Italy to utilize 10,000 horse power, especially during the night. Of course this plant has been considerably extended especially since the war. I am also credibly informed that in Germany there is a very large arc process plant working with off-peak power. At any rate there is no difficulty in doing it, whereas it is impossible to work intermittently with any other method of fixing atmospheric nitrogen.

In some ways, it is an advantage to run a plant for 8000 or less hours per year, instead of the full number, because the spare time can be conveniently used for renewals and repairs. Less spare plant is thus required and the plant can be operated by two shifts of men.

Because the plants in Norway are very large and only use hydro-electric power, a mythology has grown up, that the arc flame process can only be worked commercially on a very large scale, and with water power. As a matter fact it is well worth while to build plants of 10,000 kw.

As a matter of fact hydro-electric power may be a disadvantage because of its distance from industrial centres, for either the factory has to be placed in an out-of-the-way position, or else the power has to be transmitted over a long transmission line. I am of the opinion that electrochemical factories should be placed near the power supply, and the

* Before the A. I. E. E.

The Bugbear of Electrical Merchandising is "Inadequately Wired Houses"

The Society for Electrical Development have started out on their advertising campaign preparatory to the Service Week drive they will make in September next. It would seem that this year the Society has struck at the very root of the reason why more domestic appliances are not used in the home and that by concentrating their energies on making it possible to use these appliances, they will get much bigger results, eventually, than they could possibly do by urging the merits of equipment which, in the home of the average householder, is practically useless. By this campaign the Society recognizes the force of the argument that the weak point in electrical merchandizing lies in that overwhelming majority of poorly wired houses for which, in the main, we have the indifferent attitude of the architect to thank. The proper time to wire a house for any electric service, and to instal the necessary outlets is when the house is being erected, but these are essentials in modern home-building that are conspicuously absent from the plans and specifications of ninety-nine out of every hundred buildings. It is to be hoped the forthcoming campaign will, in part, bring this fact home to the architect and the householder alike. In that case it will have served a double purpose.

The first letter in the campaign, which has just been received, is entitled "Save food, fuel, time, money—by wire." A number of good arguments are advanced and, in the main, a strong case is made for more outlets. The following are extracts :

Does the use of electrical specialties actually conserve food, fuel, time and money in the household ?

If so, a broader, more thorough application of such devices must go a long way toward furthering war work. If not, then the figures of household statisticians, as well as the inherent beliefs of millions of housewives who have bought and are buying such appliances, are all wrong.

But that Great Purchasing Agent, the housewife, is seldom wrong in her choice of what will save labor and money in her home, and assuredly not in this case. The remarkable increase in the sale of household electrical appliances and specialties since the war began is not the result of whim, chance or guesswork on the part of that vast army of women buyers. On the contrary, it is worthy of note that the sale of such labor saving devices increases fastest in those territories where the "better half" is most active in Red Cross and corresponding war work.

Said a central station manager recently: "The more time the woman must spend outside of her home, these days, the more she turns her attention to those electrical devices that cut hours of housework off her daily schedule, the quicker she buys them, regardless of price, and the more she depends upon them."

It would be difficult to reconcile the sale last year in the U. S. of more than $10,000,000 worth of washing machines, more than $4,000,000 worth of vacuum cleaners, and more than $7,000,000 worth of other electrical labor saving appliances, with anything but the fact that there is a real and ever growing need for such appliances in the home.

Even the skeptic, who sees the electric washer save the woman a day a week (not to speak of the 60 per cent. saving in linen and lingerie saved by doing away with the washboard) cannot dispute the essentialness of this when he learns that the 200 washers sold each day last year gave the women [illegible] to do with as they wished.

[illegible] in black and white —in actual figures—take pencil and paper and do a bit of figuring in his own home. Start with the job of housecleaning. Twice a year, how many days were given over to dust-pan, mop and broom? Each day, how much dusting, sweeping, beating of rugs and carpets? Then put down against the old method the hour a week (or whatever the small amount of time) used in cleaning the "electric way." It makes no difference whether the servant had to do the work, or the housewife. Servant's time is valuable—and servants are becoming scarcer every day. Let him figure what he might save if his servant could be dispensed with. And many families are supplanting them with electrical specialties.

These are reasons enough for any intensive campaign or propaganda that helps to deliver the message of greater conservation, greater efficiency, greater economy into every home. It will hardly be denied, therefore, that the Society for Electrical Development's Campaign for a broader, better use of electrical household helps strikes a popular chord. It does not matter so much as to how the appeal is made, or what form the educational matter takes, so long as it is built on sane, sober, serious lines, such propaganda cannot fail to produce faithful returns.

The Viewpoint of the Industry

That the electrical industry, in its every ramification, is faced with serious, vital problems today will not be denied. Neither will it be contradicted that the government desires, Neither yill it be contradicted that the government desires, where and when possible, to keep business intact. It would prefer to see every business on a "going basis." It is not saying to the electrical contractor, for instance: "You shall not become an electrical merchandiser," nor does it say "If you have the opportunity to secure construction and installation business that will enable you to keep your business intact, you shall not go after it." It puts the success or failure of each man's business squarely up to each man.

The main problems facing the central station, the contractor-dealer, the electrical jobber and manufacturer require no recountal here. They are too well-known. But it is interesting to study how the forthcoming campaign will benefit each of these branches of the industry. The use of more outlets on the present lines of the central stations need not necessarily result in increased peak. It affords the quickest, easiest means of saturating present lines, of filling the valleys in the 24 hour load, and of furnishing work for salesmen who might otherwise have to be laid off.

For the contractor-dealer it offers the quickest solution of his trouble "where to get business and how." Every service connection he puts into a customer's house (new house or already wired, it matters not) can be made a revenue producer for him, for a long time to come, if he wills it. When electric service goes into the home for lighting, only the first step has been taken. The contractor-dealer, or any electrical merchandiser owes it not any more to himself than the customer, to demonstrate the utmost possibilities of that service. If the electrical specialist does not believe this, he had better take a few days off, and sell himself on his own proposition.

Finally, that which benefits the central station and contractor-dealer must benefit the jobber and manufacturer. Their cooperation in the movement is assured.

A feature of such a campaign is that it automatically adapts itself to any wiring or appliance campaign the contractor, central station or merchandiser may have scheduled for that same period. It will stimulate wiring orders as quickly as it will stimulate appliance sales, even though the drive is concentrated on additional outlets, plugs and receptacles.

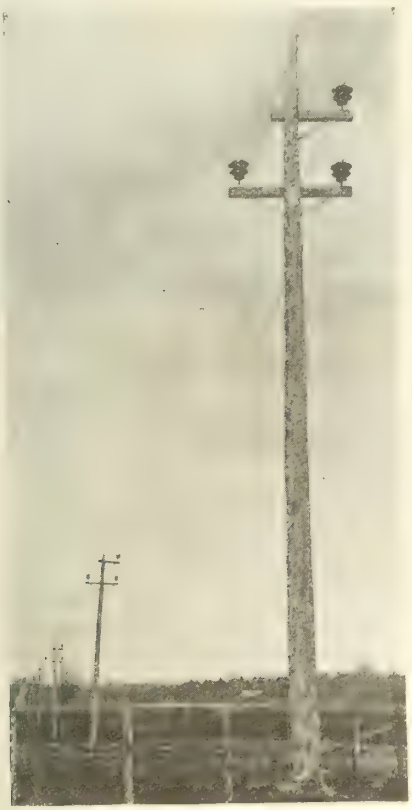
The Bell Telephone Company has moved into a new building at Smith's Falls. It is of the usual type of the company's fireproof structures, specially designed for telephone purposes, and fitted with magneto equipment.

High Tension Work in Quebec Province

Carrying out the policy of extending its system, the Southern Canada Power Company has completed and put into operation a high tension transmission line between Bromptonville and Cowansville, a distance of 78 miles. The line recently underwent a severe test in the way of a very heavy windstorm, and stood up under the strain.

The line passes through a district which has considerable industrial possibilties, and one in which new industries are being located, one reason being that, even in these times of scarcity of labor, there is a fair supply to be obtained. Naturally the availabllity of dependable power is another important consideration, and in this connection experience shows that industries will locate at points where they can obtain this power. Recently a number of copper mines have been opened up in the Sherbrooke & Eastray districts..

The line is 48,000 v. 3 phase, of 5/16 in. steel wire, re-



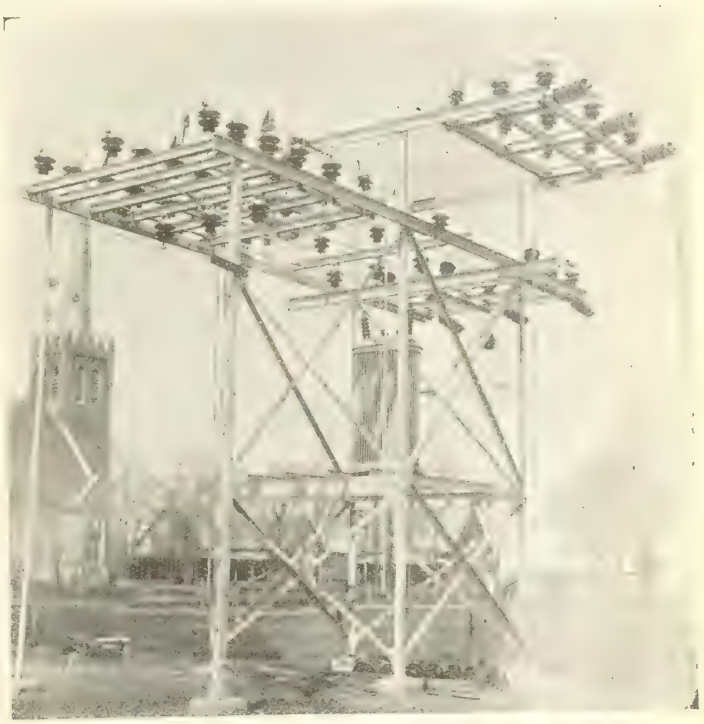
High tension line, leaving Granby.

presenting a departure in long-distance transmission in Canada. The poles are of wood, 35 ft. 7 in. tops, two cross arm triangular type, the 5/16 in. steel ground wire being on a bayonet extension at the top of the pole. A private telephone line is placed six feet below the lower cross arm.

The power is supplied from Sherbrooke, instead of as formerly, from a number of small plants along the route of the line. Sub-stations are located at Foster, West Shefford, Granby, Cowansville, and Bromptonville, with provision for sub-stations at Eastman, Magog, Rock Forest and Adamsville. Various points are equipped with a standard sectionalizing tower and outdoor sub-station, designed for 300 kw.

For crossing the river at Granby two steel towers were erected by MacKinnon, Holmes & Co., Ltd., Sherbrooke.

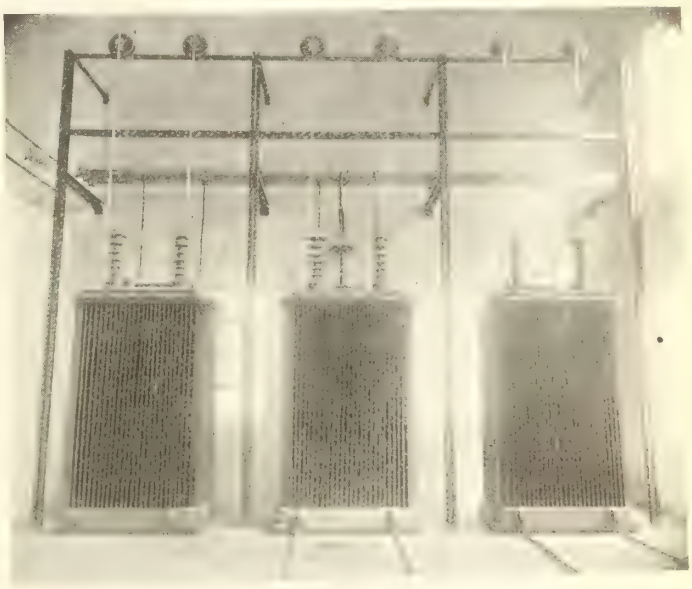
The insulators are of the pin type, tested for 125,000 volts



Standard Out-door Sub-station—Southern Canada Power Co.

wet flashover test, and were supplied by the Canadian Porcelain Co., Ltd., Hamilton.

Mr. J. M. Robertson, of Montreal, was the consulting engineer.



3-500 kw. 48,000 2400 volt transformers, Granby.

The company is also building additional high tension transmission lines connecting the new development at Drummondville with the city of Sherbrooke and with St. Hyacinthe.

A deputation from Perth, Ont., which recently waited on the Hydro-electric Power Commission of Ontario, was assured of almost immediate deevlopment at the High Falls site, recently purchased by the Commission. The work will involve an expenditure of between $300,000 and $400,000.

Electric Deliveries of Coal

By A. Jackson Marshall

Even although we are credited with relatively short memories the vicissitudes of last winter, particularly those resulting from scarcity of coal, have been too indelibly stamped on our minds to be rapidly eradicated by a few days of warm weather. Besides, there is another winter coming and there are no assurances that it will be free from vexing coal problems. Therefore, having had one series of severe lessons, and with prospects of others likely to be encountered, it behooves us to take such steps as may be necessary to adequately fortify ourselves, and one of the most important phases of the coal situation which may be anticipated and provided for is that of transportation, particularly in the delivery of coal from the railroad cars to place of consumption.

The horse, heretofore the most popular motive power, is rapidly being shown to be a liability rather than an asset, and while such means of locomotion may be called upon in emergency, the far-sighted and progressive coal dealers are rapidly discarding such inefficient motive power for the tireless, dependable, sturdy and economical motor truck; and many dealers who have approached their delivery problems from a transportation engineering basis, have selected electric trucks which have proven most satisfactory in service.

An interesting comparison of the performance of an electric truck and two gasoline trucks operated in Boston, follows: Three trucks were employed on a contract for coal to be delivered to the State House on Beacon Hill. The round trip from the loading platform was 3.7 miles, conditions of loading and unloading were exactly the same, and the time constituted a full day's performance for each truck. The "electric" was a six-ton unit, while the gas trucks were five-ton, and four and one-half ton, respectively. The five-ton gas truck delivered 49 tons of coal in 12 trips; the four and one-half ton gas truck 40 tons in 13 trips, and the six-ton "electric" 86 tons in 13 trips. The actual running time of the electric truck was from 7:12 in the morning until 4:40 in the afternoon, with one-half hour out for lunch. It will be noticed from these figures that the "electric" was consistently overloaded, and that both gas trucks were underloaded. The battery of the electric truck was "boosted" once during this period.

Electric Hauled Twice as Much.

It is interesting to note that the two gas trucks hauled practically the same amount of coal during the day that was hauled by one electric truck. That this was not a freak performance of the "electric" is evidenced by the fact that the next day the "electric" carried 12 loads of 78 tons, and the following day 12 loads of 76 tons, making a total of 240 tons in three nine-hour days. This same "electric," a few days later, on shorter hauls, delivered 123½ tons of coal in 19 loads, leaving with the first load at 7:12 a.m. and finishing at the garage at 5.05 p.m., with about ¾ of an hour rest at noon. The loading time was six minutes per load, and the actual miles covered were 26½. The company operating these trucks estimates that their per diem cost on the gasoline trucks is from 50 to 70 per cent. greater than it is on an "electric."

Follows some data on operating cost for coal delivery which was the result of four years' study and research work along these lines by the Massachusetts Institute of Technology. In studying these figures it should be borne in mind that they are average costs covering several large installations that have been in operation for a number of years.

Estimate for Coal Delivery (5 ton rating).

Average maximum load, approx.	10,000 lbs.
Mileage per trip	6
Hours per trip for loading	0.2
Hours per trip for unloading	0.7
Hours per working day	9.0

Vehicles	11,000 lb. Electric	10,000 lb. Gasoline	3-Horse wagon 2 Extra horse
Average running speed, miles per hour	6.	7.5	3
Hours per trip, standing	0.9	0.9	0.9
Hours per trip, moving	1.0	0.8	2.0
Hours per trip, total	1.9	1.7	2.9
Average no. trips per 9-hour day.	4.7	5.3	3.1
Miles per day	28.0	32.0	18.5
Tons delivered per day	23.5	26.5	15.5
Days used per year	295.0	270.0	285.0
Vehicles miles per year	8000.0	8600.0	5300.0
Tons delivered per year	6700.0	7150.0	4400.0

Expense—Annual.

Tires or shoeing, etc.	$400.	$520.	$175.
Repairs	300.	700.	100.
Battery	440.		
Veterinary			30.
Lubricants	15.	70.	
Electricity at 3c per hw.h.	290.		
Gasoline at 16c per gallon		430.	
Feed			900.
Garage or stable	270.	270.	335.
Driver and helper	1210.	1280.	1210.
Depreciation	400.	760.	
Interest	135.	150.	45.
Insurance	150.	200.	40.
Total annual expense	3610.	4380.	3135.
Cost per day	13.30	16.20	11.00
Cost per ton delivered	.54	.61	.71
Cost per mile	.45	.51	.59

It should be noted that in the above rating the price of gasoline is quoted at 16c per gallon, which is considerably below the present price, and would greatly affect the total yearly expense given of $430.

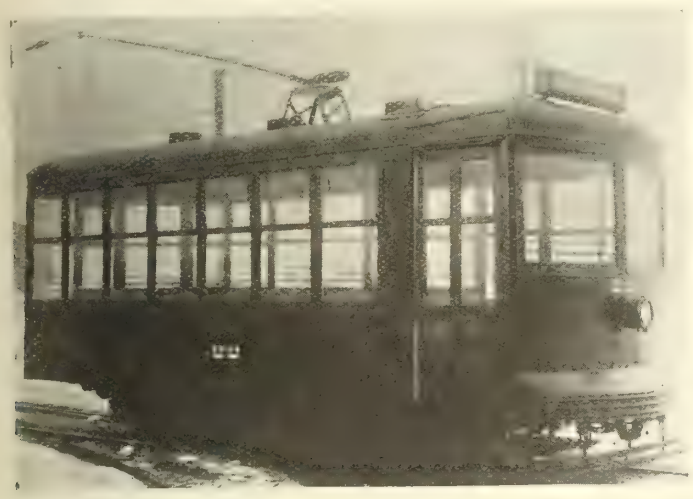
While economy and efficiency both favor the "electric," as the above statements show, there is still another factor which we have not considered and that is the humane element. Anyone who has ever watched a struggling team of horses hauling a 4 or 5-ton load of coal over wet pavement, or an icy road, or who has seen them strain every muscle, with heads bent nearly to the ground in the effort to haul this load up a steep hill, has probably been impressed with the thought that the requirements of modern haulage demand something more powerful than the "animal motor." While buildings have continued to increase in size and the demand for fuel has grown in proportion, many dealers have continued to use the same delivery methods that were used a decade ago when the horse was quite capable of performing the necessary labor. But to-day, when a commodity such as coal must be supplied in such great bulk, it is not only uneconomical to use horse equipment, but inhumane and illogical.

The simplicity of operation is also an argument for the "electric" as it does not require a skilled mechanician for a driver, and its necessary repairs are slight and infrequent —a feature of considerable importance these days of de-

pleted man-power and scarcity of machined repair material. In this connection it is noted from a report from the Glasgow Cooperative Society (London) that one of their three-ton electric coal trucks was out of commission one afternoon and the following morning during an entire year (307 working days) thus attaining a reliability coefficient of 99.65 per cent.

Three Rivers Safety Car

Herewith we illustrate the light safety car in use on the system of the Three Rivers Traction Company, Three Rivers, Que. It derives its name in part from the device by which the car is brought to a standstill in the event of the motorman taking his hand off the controller. The power is then automatically shut off and at the same time the doors of the



car are opened. In case of an accident to, or sudden illness of, the motorman, there is no danger of the car getting out of control. The car is of the one-man, pay-as-you-enter type; will seat 30 people and is fitted with an automatic sander. It was manufactured by the St. Louis Car Company, St. Louis.

Public Service at Cost

The Buzzer, the breezy little pamphlet distributed by the B. C. Electric Ry. Co. among its patrons, puts the whole matter of increased costs and fixed revenue of central station companies in a nutshell, as follows:

Public utility service at less than cost cannot go on indefinitely.

Cost includes the cost of operation and a fair return on the investment.

Public service commissions agree that in order to safeguard the public service, companies must receive sufficient to pay the cost of operation and a return on the investment sufficient to attract new capital.

Whether in the railway or the light and power department, service at less than cost means that the public service will suffer.

The Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., has purchased the property, business, and goodwill of the Krantz Manufacturing Company, Inc., Brooklyn, N.Y., manufacturers of safety and semi-safety electrical and other devices, such as auto-lock switches, distribution panels, switchboards, floor boxes, bushings, etc. The Supply Department of the Westinghouse Electric & Manufacturing Company will act as exclusive sales agents.

Women Drivers in Scotland

An interesting table appears in a recent issue of the Tramway Journal with regard to the number of women employed as tramcar drivers in Scotland, and showing the numbers of women employed as drivers and conductors on all Scottish undertakings. The percentage of female drivers is 18-6 and of male conductors, 13.

Aberdeen Corporation	100	6	10	111
Aberdeen Suburban	6	4	—	10
Ayr Corporation	5	16	1	20
Broughty Ferry	14	-	4	11
Coatbridge	4	9		20
Dundee Corporation	95	-	-	105
Dumbarton	15	3	-	25
Dunfermline	21	—	—	31
Edinburgh	251	-	7.3	214
Falkirk	7	11	—	18
Glasgow Corporation	1,276	250	253	1,435
Greenock	17	36	1	54
Kilmarnock Corporation	10	8		20
Kirkcaldy Corporation	23	—	3	24
Lanarkshire	17	104		165
Leith Corporation	32	21	10	52
Musselburgh	6	9		16
Paisley	59	-	—	77
Perth Corporation	15		15	
Rothesay	2	1	—	-
Stirling	4		-	4
Wemyss	16	-		15
	1,998	155	370	2,463

M. & S. C. Want Higher Rates

The Montreal & Southern Counties Railway Company has applied to the Railway Commissioners for authority to increase the passenger and freight rates. For the company it was submitted that the same reasons existed for increases in the case of electric railways as in the case of steam railways, and that as one had been granted there was equally good reason for the granting of the other. The united municipalities served by the lines of the company strongly opposed the application, mainly on the ground that under contracts entered into in 1909 it was agreed that the present rates and charges should stand for 20 years. The municipalities argued that this contract should be respected. Judgment was deferred.

Winnipeg Railway Changes

A reorganization of the traffic department of the Winnipeg Electric Railway is announced. There will in future be three divisions—central, south and north. Mr. C. Colwell, formerly chief inspector of traffic, has been appointed superintendent of the central division and J. S. Beckwith and M. Flood, formerly travelling inspectors, will have the north and south divisions respectivley. The divisional superintendents will have charge of the operation of all cars on their divisions and will be responsible to Mr. R. R. Knox, traffic superintendent. The company have also in view the establishing of an instruction department for new men.

The Levis County Railway, Levis, Que., intend making improvements to their track equipment. When the line was built no ballast of any kind was provided, the rails being laid on ordinary country road without drainage. The line will now be ballasted with stone; rails and ties will be replaced and necessary grading carried out.

Personals

Mr. S. A. Neilson, resident engineer of the Hull Electric Co., has been elected a junior member of the Engineering Institute of Canada.

Mr. R. G. Black, for the past four years the member of the Toronto Hydro-Electric Commission representing the provincial commission, has resigned that office.

Mr. J. A. Burnett, electrical engineer, Grand Trunk Railway System, Montreal, has been appointed technical assistant to the British War Mission at Washington.

Mr. Herbert J. S. Dennison, patent attorney, has announced his change of address from the Star Building, 18 King Street West, to the Kent Building, Yonge and Richmond Streets, Toronto.

Mr. W. Nelson Smith, electrical engineer, with twenty-five years' experience in many electric railroad centres of the United States, has recently joined the staff of the Winnipeg Electric Railway Co. He will make a study of matters affecting power requirements and distribution, paying particular attention to the elimination of electrolysis.

Mr. George H. Thompson, one of the vice-presidents of the Union Bank of Canada, has been elected a director of the Bell Telephone Company. On the board of directors he succeeds the late Mr. C. F. Sise. Mr. Thompson has lived all his life in Quebec City and was at one time president of the Quebec Railway, Light, Heat and Power Company.

Mr. George Wright has been appointed by the Hydro-Electric Power Commission to succeed Mr. R. G. Black, resigned. Mr. Wright was born in Glasgow and early in life joined the British Navy. Later he was connected with the Canadian Pacific Railway Company and is now the head of the firm of George Wright & Company, proprietor of the Walker and Carls-Rite Hotels, Toronto.

Mr. George Garret, for sixteen years master mechanic and superintendent of rolling stock on the staff of the Winnipeg Electric Railway Co., has resigned his position and will take a well earned rest before taking up similiar duties elsewhere. Mr. Garret has been succeeded by W. H. McAlloney of Halifax, N.S., who for some years was superintendent of rolling stock for the Denver Tramways.

Mr. F. F. Espenschied has resigned as assistant engineer of the Hydro-electric Power Commission of Ontario to become connected with the Combustion Engineering Corporation of New York City. Mr. Espenschied is a graduate of Cornell University, 1905, and before coming to Canada was general manager of the Interstate Light and Power Company, Galena, Ill., and previous to that with the West Penn Power Company at Connellsville and Pittsburgh, Pa.

Lieut. C. E. Knox was among those included in a list of officers, mentioned in dispatches by Sir Douglas Haig for conspicuous work in France. Lieut. Knox is a son of R. R. Knox, traffic superintendent of the Winnipeg Electric Railway Co. He has been in France for the past two years having left with the 101st battalion. His entire platoon was made up of conductors and motormen. Lieut. Knox was in the employ of the company, before going overseas, as chief clerk to his father.

Mr. J. E. Brown, general manager of the Ottawa Hydro-electric Commission, has been elected a member of the Engineering Institute of Canada. Mr. Brown, who commenced his electrical career with the Royal Electric Co., Montreal, has been connected with the Standard Electric Co., Ottawa, Deschenes Electric Co., P.Q., Hull Electric Co., Ottawa, and Hull Power Co., Consumers' Electric Co., Ottawa, and since 1905 has been with the Ottawa Hydro-electric Commission, of which he was appointed general manager in 1912.

Mr. J. S. Gillies, of Gillies Bros., Ltd., lumber merchants, Braeside, and Mr. Harry A. Sifton, Ottawa, son of Sir Clifford Sifton, have joined the Board of the Southern Canada Power Co., while Mr. C. J. McCauig has retired. The Board is now constituted as under: Messrs. W. C. Hawkins, president; F. W. Teele, vice-president; Jas. B. Woodyatt, general manager; L. C. Haskell, secretary-treasurer; W. K. Baldwin, H. T. Chalifoux, James Davidson, W. H. Miner, Lt.-Col. J. R. Moodie, A. J. Nesbitt, Geo. Parent, K. C., Chas. E. Read, J. M. Robertson, C. W. Tooke, J. S. Gillies, and Harry A. Sifton.

Obituary

Mr. Charles Cassils, vice-president of the Bell Telephone Co., and director of the Northern Electric Co., died in Montreal, on July 2nd, aged 77. Mr. Cassils, who was a Scotchman by birth, was also a director of several other companies. He was identified with the iron and steel business, representing British and American companies.

Speaking at a recent gathering of telephone employees, Mr. Cassils related how he came to this country on the same vessel as Alexander Graham Bell. Mr. Bell was accompanied by his father and mother, the latter of whom was very deaf. Mr. Cassils recalled the fact that when Mr. Bell played the piano Mrs. Bell used a very large ear trumpet, which was placed right into the piano. Mrs. Bell's deafness was one of the reasons which led Mr. Bell to study the subject of sound, and which resulted in the invention of the telephone.

Wilford Phillips, for seventeen years general manager of the Winnipeg Electric Railway Company, passed away at Rochester, Minn., on June 12th, following a prolonged illness and an operation. Mr. Phillips retired from his post as general manager of the company on October 1st, 1917, as a result of ill health, and from that time until his death had been under the doctor's care. His remains were interred at Toronto.

The late Wilford Phillips was born on Oct. 8th in Prince Edward County, Ontario. He remained on the farm until he was 28 years of age, during which time he gathered a knowledge of engineering, and in March, 1890, accepted a position with the Metropolitan Street Railway, Toronto, the first railway to successfully operate an under-running trolley road in Canada. He remained there until July, 1892, when he accepted the position of engineer and superintendent of the North Toronto Waterworks and Electric Light Co. In March, 1893, he became engineer of the Niagara Falls Park and River Railway and in 1896 was appointed manager of the same company. In June, 1900, he resigned, and in August, 1900, accepted the managership of the Winnipeg Electric Railway Co. He was married in June, 1881, to Susan Dorland of Prince Edward County. His wife and one son survive him.

Electric Light for Matheson.

The ratepayers of Matheson, Ont., decided on Friday, June 28th, to accept the scheme for an electric lighting and pumping plant which had been submitted by J. Everard Myers, electrical contracting engineer, of Toronto and Haileybury. The plant will consist of oil engine, 550 volt generator, exciter, main switch board, transformers, 40 street lamps and overhead feeders 1½ miles from town for driving pump, consumers lighting, etc. The plant will cost about $10,000. The council are arranging for the poles and erection of same. All other work will be carried out by J. Everard Myers. The lighting will be ready for use by October.

Plans for enacting legislation in the United States authorizing government control of telegraph, telephone, cable and radio systems, are under way.

The Dealer and Contractor

How a Small Merchandising Business was Turned into a Huge Success by Applying a Few Practical Ideas

There is an old saying that "nothing succeeds like success," and yet it is probably nearer the truth that the same policy that produced the original success is the cause of its continuance. If a man is successful in business it is generally because his methods are right and, vice versa, if his merchandising methods are good, business success is almost inevitable. This is as true of the electrical contractor-dealer as in any other kind of business.

An interesting story of merchandising success was recently told before the Wisconsin contractor-dealers by Mr. Acker, of Sheboygan, and is reported in Electrical Merchandising, as follows:

In our old building we were doing a merchandising business that ran from $50 to $75 per month, but the basement location did not seem to be suited for retail trade so we decided to move. We bought a building. The building we purchased did not prove to be entirely suitable for our purpose, however. It was a two-storey affair about 18 ft. wide and was so arranged that it was necessary to put the fixture stock on the second floor. We found it was difficult to get people to go upstairs to look at these things, so after a very short stay here we decided on making another change.

We were very fortunate in being able to lease at a favorable figure a building in the very heart of the retail district of the city. At the same time we found it possible also to rent the building we had purchased, at a figure high enough to pay our rent in the retail section. We had the owner of the leased building put on a good front for us, and moved uptown.

We fitted up a rest room in the front of the building with rugs, rocking chairs, a telephone from which free service was furnished, and other accommodations, which pleased the feminine trade.

Then we began to work all sorts of schemes and ideas to get the women to come into our place of business. We let it be known that this front vestibule was open to the women for all sorts of public work. They have conducted Red Cross and Liberty Loan campaigns from this headquarters regularly until it has become one of the downtown social centres.

Since we recognize that a great deal of our trade does come from the women, we make an extra effort to keep the store clean. It is scrubbed and swept with precise regularity. Moreover, we have gone in rather strong for 'Warner' cases so that a woman does not have to know the name of a piece of electrical goods in order to buy it. She can walk up to one of these cases and say 'I want one of those,' pointing out the article to which she is referring, and can get it without any lengthy conversation with the clerk.

We make it a point to carry a good line of the expensive hollow ware. Some of this runs from $50 to $75 a set, but it gives the store tone, and we manage to turn over enough of it to make it pay to carry the line. Our women customers help us very materially in this.

The fixture business is now carried on on the ground floor. Three booths have been constructed for this business. In connection with the fixture trade we have done something which I believe is extraordinary, in that we have built up a considerable business in dresser brackets. We have put fixtures of this sort on some of the best furniture in town, and we consider it extraordinarily good business because the installation of fixture brackets always makes for additional outlets on any wiring job.

I have known of instances wherein twenty-five to thirty additional outlets have been placed in a single house owing to the necessity for providing current taps for these dresser brackets. Sometimes as many as five outlets will be placed in a single bedroom to make it convenient to hook up the dresser in several of the locations which it may occupy at different seasons.

In connection with the dresser bracket idea it is always possible for us to talk heating pads which also furnishes the store with profitable business. It is our policy, in talking about these dresser brackets, to quote the price for the bracket installed with the outlets in a lump sum. The prices for the installation of these brackets run from $3.50 to $8 apiece. The value of carrying out the fixture business along these lines may be judged from the fact that our fixture business has increased about 500 per cent since we have moved into the new store.

In fact, by improving the looks of his store both as to exterior and interior appearance, the contractor-dealer puts himself in a position where he cannot avoid getting increased business. Over the counter in our new store during the first year we did a business of from $150 to $200 a month. At present our cash sales will run from $500 to $700 a month. The sales which are made on charge accounts will add approximately 50 per cent to this figure.

It is my opinion that a store which will do a real merchandising business along these lines need not fear competition from its local central station. Last fall we made a record of our sales and reduced this record to wattage so that we could show the record to the officials of our light and power company. At this time they were thinking about starting a merchandising department. When they discovered what a thorough job of loading their lines we were doing through our merchandising activities, they stated that our store was of as much value to their company as any merchandising department operated by other properties in the same sydicate. They of course decided to let well enough alone and have not gone into the merchandising business in Sheyboygan.

The problem of jobber competition likewise will take care of itself if merchandising is handled on a businesslike basis. When the jobber sends the contractor-dealer a letter stating that a certain firm in his town has asked for prices on an electrical product, the contractor-dealer should go out and get the business and answer the jobber's letter.

Too many contractor-dealers take the stand that the

man will have to come into the store and buy the material anyway, so it is no use to follow up the jobber's inquiry closely. This sort of inactivity leads to calls by the jobbers' salesmen upon the prospective customer, and of course leads to loss of business.

A bigger problem than handling central station or jobber competition is the problem of handling store help. I thoroughly believe that the contractor dealer should delegate to his store help, full authority to run the store. It is a very good thing for him to be around and to do missionary work, and to handle cases where customers demand to see the owner of the store. Nevertheless, the force should be sufficiently well trained and sufficiently competent to handle any problems that come up. At my store the force consists of a girl, a bookkeeper and one additional man, all of whom are capable of quoting on small wiring jobs.

"To sum up, it seems to me that the cardinal points in bringing to the store of the contractor-dealer a bigger volume of merchandising business are: (1) To conduct a consistently clean place of business; (2) To work all sorts of plans to get the women to come into the store; and (3) To use every means possible to impress upon the customers the fact that they get courtesy, even down to the point of being waited on in their proper turn."

How to Increase the Sale of Electrical Appliances —Everything Depends on Co-operation of Manufacturer, Wholesaler, Contractor and Dealer

Plans for the success of any electrical merchandising campaign cannot be carried through unless complete unanimity prevails among the various interests. Neither can such plans be carried out by a few. There must be team work and everybody must be in it. This is the text of an address by Mr. J. G. Spurr, recently delivered before the New Jersey Association of Electrical Contractors and Dealers, when he spoke of plans to increase the turnover of every man in the state connected in any way with the electrical business.

One object of the plan is to vastly increase installations for electric service, to make these installations better, to increase the sale of current consuming devices, which will, of course, be followed by an increase in the consumption of current. Fundamentally, we must recognize that our business possibilities increase directly with the increase of installations for electric service. Therefore, it is the avowed intention to vigorously go about the increasing of these installations so as to increase the electrical business opportunities as to the sale of appliances, supplies and labor.

The first movement will be the education of the general public to the valuable service that can be had by the use of electric service in connection with light, heat, cooking and power. We will then take up the education of the architects and owners of buildings to be more complete in their plans.

For every new circuit installed will make added business immediately for some one, and open a field for the future, that would be restricted by just that much were the circuit not available.

Organization.

The work that is being done is the organizing of the different branches of the industry. One organization, that of the manufacturers, one that of the jobbers, and one that of the contractors and dealers. Each one of these separate organizations to carefully consider their interest in the matter, to thrash out the objects they wish to attain. To have these objects so broad that they can be subscribed to by the vast majority of all concerned, and then to bring these organizations together to be molded into a single group representative of the whole, with a declaration of principles, and a code of ethics that will insure success for future efforts.

Jobbers' Organization.

We are organizing all the electrical jobbers, both large and small, who are located in the State, into one general organization, which will meet each week for the purpose of discussing ways and means for the increase of sales of electrical merchandise, and to appoint such committees as are necessary to co-operate with the electrical contractor and dealer, and with the lighting companies for the purpose of assisting them in educating the architects, increasing the demand for quality goods, and insuring the maximum outlets being provided for in all new buildings, and co-operating with them in all ways that will tend to increase electrical current consumption.

Contractors' and Dealers' Organization.

In the organization of the contractors and dealers it is intended to include all individuals, firms, and corporations that engage in the business of electrical contracting and the retail dealers in current-consuming appliances. This organization, through committees, to work in harmony with other organizations connected with this movement to do their part to attain the common goal.

Manufacturers' Organization.

The organization of the manufacturers will wait on the successful organization of the jobbers and the contractors and dealers. When this is done the manufacturers will undoubtedly organize on similar lines.

A movement of this kind must necessarily be in the hands of those who have gone into the details of the operation and know the possible results. Certainly, no man in business can be hurt by what it is intended to do, and it is just as certain in my opinion that if carried to a successful conclusion the individual interest of every man in the business will be served in a most substantial way and increase in gross and net profits must result.

I would like to have you consider the Goodwin plan under which we are operating.

1. The Goodwin Plan—

A plan of organization strong enough to undertake the solution of all problems affecting the four branches of the industry and to provide a code of principles or ethics by means of which all interests can work harmoniously, each paying due respect to the functions performed by the other without discrimination to any branch or to the public in general.

2. Joint Action is Necessary—

Without joint action, i.e., all four branches of the industry working in harmony, it is impossible to reorganize an industry, much less the electrical. Contractor-dealers, jobbers, manufacturers and central stations, must have their associations, and these associations working through their joint committees can eliminate many of the ills of the industry.

3. Let Us Face Facts—

The old basis of competition was price. The new basis is service. Your business cannot stand still for any length of time—it must either advance or go backward. A successful business requires time, money and knowledge, which is true of the electrical and all industries.

4. Stand by Your Leaders—

(a) As industrial and commercial enterprises expand, the demand for able leadership becomes more and more insistent.

(b) No plan, no matter how well designed or how carefully installed, can be effective unless all who are concerned in its operation co-operate to the full extent of their ability

and stand by their leaders, irrespective of the fact that they may be wrong temporarily.

5. The Closed-Door Policy—

Nothing can be gained by keeping allied interest in ignorance of your operations. Associations are built on the principle of the co-operation of all, not on the will of a few. Nothing is more destructive than suspicion of action or intentions.

6. Statistics will show Contractors Importance—

The electrical contractor is the largest single factor in the purchase of electrical material, but because he is poorly organized has less to say about its distribution than any of the other branches of the industry.

7. A Good Sale is a Good Buy—

(a) It is recognized to-day to be both poor ethics and bad business to stock a dealer with anything that he cannot sell to advantage.

(b) A sale is not a coldly scientific process; it is a friendly red-blooded man-to-man transaction.

9. Develop Non-Competitive Business—

(a) Many who would never take a five cent piece belonging to another appear to have no conscientious scruples about cutting when he knows the price of the other man.

(b) In the best sense true profits are the rewards of a real service, of foresight and judgment, which often requires courage, good sense and great ability.

(c) The business cemetery is full of contractors and jobbers who have tried to sell their service too cheap.

10. Help Your Jobber and Let Him Help You—

(a) Partly because of the general ignorance of the jobber's service, a suspicion has arisen that his service is uneconomical and not worth the money to be paid for it.

(b) The middleman is influential in helping to establish relatively uniform prices over comparatively large areas.

(c) The services rendered by the jobbers is that of a specialist in distribution.

(d) Prices must never get so low as to eliminate margins of all who serve.

(e) Goods are made for the consumer, not the jobber or dealer, and so every step in distribution must be planned for the needs of the consumer.

In closing, gentlemen, I wish to say that the next step forward in the organization of our industry will be along the lines of finding and adopting the true standard conditions under which we shall all labor.

National Contractors' Convention, July 15-20

The 18th annual convention of the National Association of Electrical Contractors and Dealers will be held in Cleveland July 15-20 inclusive. An attractive programme has been prepared, including the following papers: Scientific System of Wage Adjustment, by L. K. Comstock; Organization, by James R. Strong; The Goodwin Plan, by W. L. Goodwin; How to Open a Retail Store, by G. M. Sanborn; How an Electrical Contractor Can Become a Successful Retailer; The Application of Electricity as Applied to Industrial Plants; and so on. Doubtless the greatest interest centres around a discussion of the famous Goodwin plan, which its originator designed to bring into closer touch the contractor, the manufacturer, and the wholesaler. There is plenty of evidence that this plan is working well, but it is also evident that all the ills of the electrical industry have not been removed as completely or as quickly as it was anticipated they might be, by a closer cooperation of the various elements of the trade, when this plan was originally suggested. There seems to be a tendency to take it for granted that this plan will work itself out, when, as a matter of fact, it will be necessary that the various contractors' associations be constantly on the alert that their enthusiasm and the enthusiasm of the manufacturers and wholesalers does not wane.

As announced in last issue, a number of members of the Toronto Electrical Contractors' Association will attend this convention. A registration fee of $5.00 will be charged to help defray convention expenses. The convention is open to any one who is sufficiently interested to attend and listen to or take part in the discussions.

"Pegging Away"—Do You Happen to Know Jim?

The loafers gather on the steps of Jones' Electric Store; there's dust on Jonesey's counter; there's junk on Jonesey's floor. There's a snag in Jonesey's system—that's as plain as A B C; not a thing that's ever wanted is where it ought to be. Jim never cleans his windows—says it makes the light too strong; he never straightens out his stock—it takes too cussed long. Jim Jones abhors "fine fixin's," says he doesn't think they pay. "I'll git along," says Jim, "as long as I kin peg away." So Jim he pegs away at this and pegs away at that, sells Mrs. Binks an iron, or wires up a flat, takes an order for a washer, or sells an eight-inch fan. He pegs away at keeping store and does the best he can, but with all of Jim's persistence he doesn't get ahead—says business needs assistance, that the dad blamed town is dead. So he tinkers in his workshop, says he "hopes to make 'er pay," and "By Heck, I don't see why she won't—I always peg away." Jim could take a hundred hunches from the grocer up the street, who sells green stuff tied in bunches, who is bugs on being neat, who never mixes spuds and greens, or cabbages and peas, who keeps his records perfect, and collects his bills with ease, who knows the cash that each day brings, the profit on each sale, knows how to watch the little things and gather in the kale. That's why this man of corn and beans can joyride in his bus, while Jim, who ought to have the means, must peg away and cuss.—Contact.

New South Philadelphia Works of the Westinghouse Electric and Manufacturing Company

Spurred on by the urgent need of the government for ships, the Westinghouse Electric and Manufacturing Company has made a record in the erection and operation of its South Philadelphia Works, now devoted entirely to the production of ship propulsion machinery for the Navy and the merchant fleet. A little over a year ago, the present site was plowed field; now it contains seven large buildings which gives employment to 2,500 people. These buildings, comprising a floor space of over 600,000 square feet, include a pattern storage shop, foundry, forge shop, power house, erecting shop, and two machine shops. It is expected that eventually, this plant will be of a size comparable with the East Pittsburgh Works, which now employ in the neighborhood of 25,000 people, and cover a floor space of over 100 acres. A portion of the land will be devoted to a townsite capable of accommodating about 5,000 people.

A number of tool manufacturers are devoting a considerable portion of their facilities to the manufacture of tools needed by the United States Government to help win the war. Prominent among them is the Smith & Hemenway Co., Inc., whose plant at Irvington, N.J., is very largely given over to the making of tools for Uncle Sam. The "Red Devil" tools have proven so satisfactory to the Government that Smith & Hemenway Co., Inc., have been obliged to put up a new building, which is now being completed. New machinery of the latest design is being installed, and the result will be an increased output and a saving of time in producing it. Late last year the factory in Hill, N.H., added a new building, which has increased the facilities for producing "Red Devil" glass cutters at that factory.

What is New in Electrical Equipment

Motor-Driven Machines in Cork Factory.

Progressive manufacturers of bottle-corks find that production is multiplied and costs reduced by the installation of electrically-driven automatic machines. A glance through one of these modernized cork works is quite interesting. The raw cork is imported from Portugal and arrives at the factory in flat blocks from ½ to 2½ inches thick. The first operation is to cut these blocks into strips the width of which is determined by the length of the corks to be made. For this process circular saws are used, each being driven by a Westinghouse alternating-current motor running at a speed of 1725 revolutions per minute. As the strips are sawed they drop into large baskets, and are then taken to the punching machines.

In the older factories the punching machines were arranged in groups and driven from a line shaft. The punching was done by a rapidly revolving cylindrical knife which could be moved sidewise by operating a pedal. Thus the operator fed in the strips of cork and punched out each cork by pressing the pedal. In our improved factory we find these machines each driven by its own ¾ horsepower Westinghouse motor and operating two punches instead of one. No special skill is required of the operator who simply feeds in two strips of cork, all other operations being performed by the machines and the finished cylinders dropping into barrels behind the machines.

Many of these straight cylindrical corks are used in this form, but for most purposes they must be tapered. The



Cutting cork into strips—Four circular saws each driven by a one horsepower Westinghouse single-phase motor.

tapering machine is entirely automatic. The cork cylinders are thrown into a large hopper which narrows at the bottom to a pipe, through which the corks pass in single file. At the end of this pipe a mechanism seizes each cork and holds it against a disc-shaped knife revolving on a horizontal plane. This knife removes a thin shaving which is carried away by the exhaust system, while the finished cork drops into a basket. This machine can be adjusted so that any desired degree of taper can be obtained. Ten of these tapering machines, a knife-grinder, and a blower are driven as a group by a Westinghouse squirrel-cage induction motor of five horse-power capacity.

After being tapered, the corks are sorted by hand, no machine having as yet been designed which will successfully perform this work. In the highest grade, the corks are



Punching cork cylinders from strips—Five automatic Duplex cork machines, each driven by Westinghouse alternating-current motor.

smooth and almost free from imperfections, while in the lowest grade they are coarse and full of small holes and woody ducts. Between these extremes are various grades according to the degree of perfection and the uses to which they are to be put. The last process is cleaning and polishing the corks, which is done in a tumbling barrel, after which they are ready for market.

Siemens Now Entirely British

The firm of Siemens Bros. & Co., Ltd., London, Eng., with an office in Montreal, is now entirely British, the German interests having been eliminated. The Siemens Bros. Dynamo Works Ltd. has been taken over by Siemens Bros. & Co. It was stated at the annual meeting in London that the business in 1917 was a third larger than that of the previous year, and that the expansion was principally in insulated wire and cables, ebonite and batteries. Considerable work had also been done in installing automatic telephone exchanges.

Since the entry of the new directors into office negotiations had been inaugurated with other companies doing similar industrial business with the object of bringing such manufacturers together for the reduction of unnecessary competition and the avoidance of duplicating machinery workshops, and offices. Co-operation would make for the more continuous running of plants, with the attendant advantages of cheaper production, increased efficiency, and improved quality of the work done, avoiding unnecessary expense in storage, selling organizations, and reducing the duplication of stocks to a minimum. An even more important advantage aimed at was the amalgamation of designing offices, and interchange of experience, designs, and methods to the promotion of economy and efficiency. Such industrial alliance would, moreover, make it possible to carry out complete installations within the allied group. An alliance of this nature had already been arranged with Messrs. Dick, Kerr and Co. Ltd., in the field of dynamo installations in all its ramifications and other alliances were contemplated.

A Compression Chamber Arrester for 10,000 and 13,200 Volt Circuits.

To protect pole type transformers on 10,000 and 13,200 volt distributing lines, the Canadian General Electric Company has placed on the market a unique form of compressor chamber, multigap lightning arrester in which is embodied the shunt resistance principle, Fig. 1. Gaps of a simple, though rather unusual design, are connected in shunt with and mounted on, the resistance rods from which they are suitably insulated. The arrangement of the gaps and resistances is shown in Figs. 2, 3 and 4. Protection from the weather is obtained by enclosing the gaps and resistances in a porcelain tube. By reason of this combination of gaps and resistances the arrester will discharge at low rises in potential, is sensitive to lightning over a wide range of frequency, and following the lightning discharge, quickly cuts off the generator current and prevents "grounds" or "shorts."

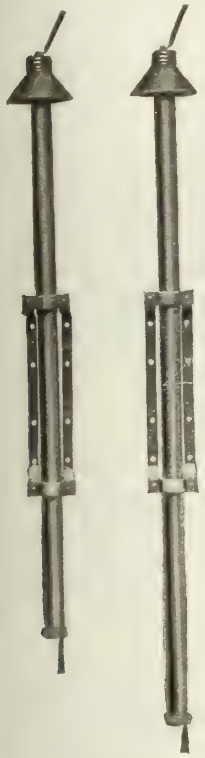


Fig. 1

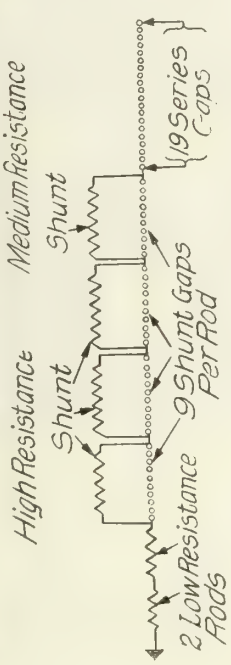


Fig. 2

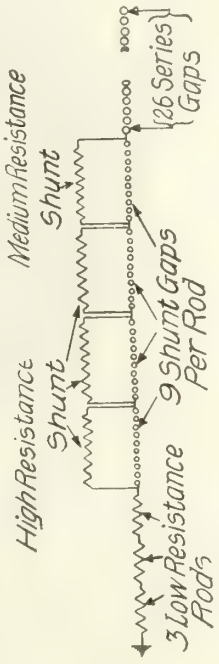


Fig. 3

Several paths for the lightning discharge through the arrester are offered by the four units of shunting resistance

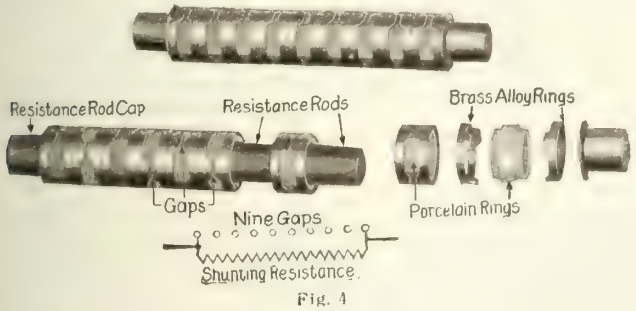
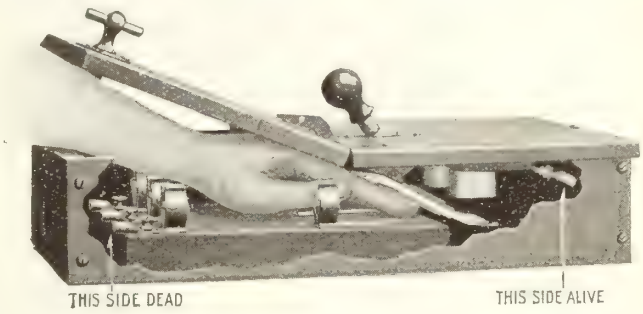


Fig. 4

used. As the resistance rod in contact with the series gaps is grounded through the other resistances the initial discharge is made easy, because the ground potential is brought up to the bottom of the series gaps. The path which the discharge takes after passing through the series gaps depends on the frequency and quantity. Very high frequency will discharge straight across all the gaps. Discharges of lower frequency will take place through one of the shunt paths. The generator current which follows the lightning discharges will shunt to the resistance rods, being thus limited to an amount that can be extinguished readily by the series gaps. The arrester affords complete protection and is light, efficient, compact and proof against fire and weather. It is recommended for outdoor installations of small capacity transformers.

A Real Safety Switch

In many steel mills, factories, mines, and similar industries where most of the workmen have little knowledge of electricity, it is desirable to use switches having no live parts exposed or accessible in the ordinary operation of the switches or when replacing fuses. This is fully accomplished in the Krantz auto-lock switch, now marketed by the Westinghouse Company which is intended for use on main circuits or wherever an ordinary knife switch is applied. The switching parts and fuses are enclosed in a steel box, the cover of which is in two parts, one part being screwed on to form a permanent covering for that end of the box containing the switch, and the other part being hinged so as to swing back and permit the renewal of fuses, which are located in this portion of the box. An ingenious latching mechanism makes



it impossible to open the cover without first throwing the switch to the "off" position and rendering all fuses and other accessible parts dead. Thus fuses may be replaced at any time with absolute safety. As long as the door of the case is open, the switch contacts can not be closed. By using a padlock, the switch handle can be locked in the "off" position, making it impossible for any one to close the switch, except the person holding the key to the padlock. By using another padlock, the cover may be locked shut, so that the fuses cannot be tampered with. Either of these padlocks can be used independently of the other, so that the switch cover can be locked shut with the switch either "on" or "off," or the switch can be locked in the "off" position with the cover either locked or open.

Contact is made by means of a laminated spring copper brush, double ended with auxiliary arcing contacts at each end. The outer leaves of the brush are bronze to provide ad-



ditional spring pressure. The stationary contacts are of hand-drawn copper and are mounted on slate bases, one of which in the fused switch carries one of the fuse clips while the other forms the terminal block for the incoming line and is mounted under the stationary portion of the cover. The operating mechanism is galvanized steel of the toggle type, and is attached to the under side of the stationary end of the cover. This mechanism can be easily removed for inspection

[illegible] several screws. In closing, the pressure between the contacts causes the laminations of the brush to spread apart, giving it a wiping or self-cleaning action. The so-called brushes provide a double break, dividing the [illegible] between the two ends, each of which is provided with a separate arcing tip. In the closed position the switch is held in positive contact by throwing a toggle over centre. A spring provides a quick-break for opening, the mechanism being independent of the operating handle. These switches are supplied for 250, 500 and 600 volt, for either alternating or direct current service, and in capacities up to 2,000 amperes. The safety features of this switch have been recognized by the American Museum of Safety which has awarded it a gold medal and special mention.

Armored Corner Insulators for Feeder Cables

A new Pittsburgh-type corner insulator, for securely holding feeder cables on curves, is being marketed by the Westinghouse company. It is provided with a special collar or rotating ring for use where the curve is slight and the cable likely to slip off an ordinary insulator. This collar has an extended lip which curves up around the cable and keeps it in the groove regardless of the angle at which the cable turns. This eliminates the necessity for tie wires and saves time in



erection. This collar is free to move on the insulator cap, so that after the insulator is screwed to the pin, the collar may be turned until the cable seat is in the proper position best to support the cable. For sharp curves, the insulator can be used without this collar, as the deep side groove holds the cable firmly in position. These insulators are made of moulded insulation surrounded by a sherardized malleable iron cap. They are made with a one-inch pin hole and are furnished in two sizes for feeders of 500,000 and 1,000,000 circular mils respectively.

Important New Motor Book.

Lair & Lee, Inc., Chicago, announce that they have now in press the 1918-1919 edition of "The Modern Motor Car," by Harold P. Manly. It will be issued in one compact volume of 536 pages, large 12mo, with 225 illustrations from detail drawings and photographs, and a 24-page alphabetical index, durably bound in flexible keratol, with round corners and colored edges. The revisions and additions bring this standard work up to the very minute, making it a complete, practical and handy reference cyclopedia on all matters connected with the care, repair and upkeep of every type of automobile, old and new. Price $2.00, postpaid.

Mr. Calhoun Gets Promotion.

The appointment of Mr. L. D. Calhoun as assistant sales manager, has been announced by the Square D Company, Detroit, manufacturers of electrical safety switches. Mr. Calhoun has been advertising manager of the Square D Company for the past year, and in addition to his new duties, will continue to handle the company's advertising.

The Dominion Bridge Company has received an order from the Imperial Tobacco Company, Montreal, for a 400 k.w. turbo-alternator.

Banfield Show Rooms on King West, Toronto

W. H. Banfield & Sons, Limited, have taken over the buildings at 80 King Street West, Toronto, where they have opened up new and up-to-date showrooms and sales office, taking in the whole three floors. This company will now have all facilities for taking care of their city and out-of-town customers. They will show a full line of fixtures and fixture parts, fittings and accessories; also a full line of glassware and portable lamps.

Two More Bucyrus Shovels for Hydro

The Ontario Hydro-electric Commission has just acquired through the Canadian Equipment Co., Ltd., Montreal, two additional Bucyrus electrically operated shovels, making a total of eight shovels sold to the Commission. These shovels are used in connection with the new 300,000 h.p. plant of the Commission, the work on which is now being proceeded with.

H. W. Gillett, chemist of the Bureau of Mines, Washington, D.C., after five years' experimentation, carried on in co-operation with the laboratory of Cornell University and the American Institute of Metals, has announced a perfected electric melting furnace which, it is stated, will revolutionize the making of brass.

The aldermen and commissioners of Montreal have decided to appeal to the Public Utilities Commission against the increase in the fares of the Tramways company recently granted by the Tramways Commission. There has been a certain amount of opposition on the part of the public to the increases, the proposal to impose a cent for a transfer being objected to in particular.

Trade Publications

The Crouse-Hinds Company of Canada have issued a colored folder emphasizing the care with which their products are packed, catalogued and shipped.

Boiler Feed Pumps—Pamphlet issued by the De Laval Steam Turbine Co., Trenton, N.J., entitled "Centrifugal Boiler Feed Pumps," describing the De Laval combined steam turbine and centrifugal boiler feed pump.

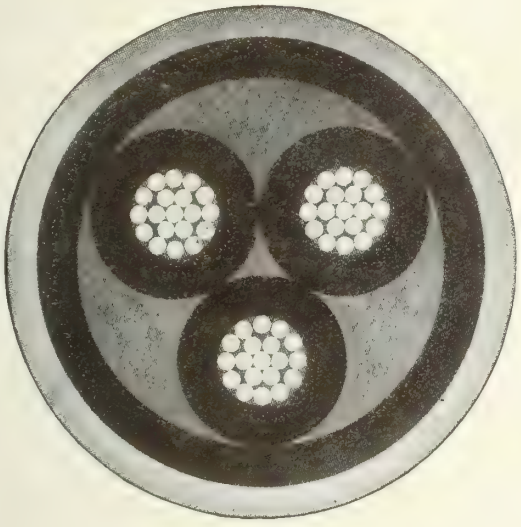
A handsome catalogue is being distributed by the Jefferson Glass Company, Limited, Toronto, describing and illustrating their color decorations, etchings, cuttings and other finishes on illuminating glassware. This is known as catalogue No. 6, and will be mailed on request. The catalogue contains 70 pages of very attractive and interesting matter.

L'Air Liquide Society are distributing copies of their new catalogue, which has just been issued. In the preparation of this catalogue the company have departed somewhat from the usual method of preparing such publicity matter and have given a comprehensive, though necessarily somewhat curtailed, outline of the oxy-acetylene process of welding and cutting in its many useful and indispensable applications. It also mentions the chief characteristics of the apparatus. The company announce that a copy of this catalogue will be sent on request to anyone interested in the oxy-acetylene process.

C.G.E. Publications—Bulletin No. 46018-A, describing portable instruments, type P-8; also descriptive folders covering the following: CR 3105 drum-type controllers; CR 2940 push-button stations; CR 2820-784 overload relay for use with magnetic control panels on a.c. or d.c. circuits; CR. 2820-723 current-limit relay; CR 3100 drum type controllers; Catalogue No. 618, twelve pages illustrating and describing C. G. E. pipe fittings; Catalogue No. 257, twenty-two pages, illustrating and describing Regent bowls, globes and reflectors for commercial and ornamental illumination.

PHILLIPS' CABLES

as supplied to the Toronto Hydro Electric System





These illustrations show cross sections in the original size of cables recently supplied to the T. H. E. System and reordered by them for further extensions. The specifications are as follows.—Conductors composed of 37 strands each, .082 in. diameter. Thickness of dielectric on each conductor, .210 in. Thickness in belt, .210 in. Thickness of lead sheath, .160 in. Overall diameter, 2.61 in., 250,000 C.M. Three Conductor, Paper Insulated, and plain Lead Covered Cable for 13,200 volts. We can supply you with wires and cables of any size for Power, Lighting, Telephone, Telegraph, etc.

Write us for detailed information.

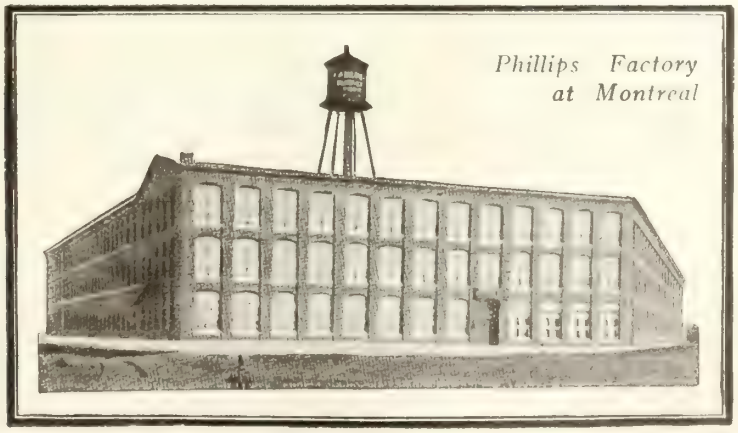
NOTE.—Specification of cable in left-hand cut: 3/0 B. and S. Three conductor. Each conductor 19 strands, each .094 in. diam. Thickness of dielectric on each conductor, .21 in. Thickness of dielectric on belt, .21 in. Thickness of lead sheath, .15 in. Overall diameter, 2.60.

Specification of cable in right-hand cut: As stated in copy.

Eugene F. Phillips Electrical Works, Ltd.

Head Office and Factory: MONTREAL

Branches: Toronto Winnipeg Regina Calgary Vancouver



Phillips Factory at Montreal

Current News and Notes

Cornwall, Ont.

Work on the new transformer station a short distance west of Cornwall, Ont., by the Hydro-electric Power Commission of Ontario, is progressing favorably. The foundation is ready for the concrete which will be poured shortly. Brockville and Prescott will be supplied with current from this station when completed.

Fredericton, N.B.

The Maritime Electric Company, Fredericton, N.B., have been granted a Dominion charter with hydro-electric powers and an early development is anticipated. Several sites are under consideration. In the meantime sufficient new equipment is to be purchased to allow the company to generate current sufficient for all present requirements.

Gladstone, Man.

A by-law providing for the sum of $15,000 to be spent on an electric lighting system, has been passed by the ratepayers of Gladstone, Man. The Echo Flour Mills Company of Gladstone will generate the necessary current.

Kirkland Lake, Ont.

Arrangements have been completed for the installation of electrically-driven mining plant at the property of the Ontario Kirkland gold mines about two miles south of Kirkland Lake. The work of clearing a right-of-way for pole line is proceeding.

London, Ont.

The annual meeting of the Western Counties Telephone Association was held in London recently, about fifty members attending. Mr. John Perry, of St. Marys, was elected president for the coming year; Mr. James McEwing, of Drayton, first vice-president; Mr. J. R. Forbes, of Waterford, second vice-president and Dr. W. Doan, of Harrietsville, secretary-treasurer.

Moncton, N. B.

A device for telephoning from moving trains has been successfully tested on the Intercolonial Railway at Moncton, N. B. The instrument has been patented by Isidor, Abraham and Samuel Berliner, of Toronto, who have also submitted to the United States government a device for detecting submarines. It is stated that three conversations can be carried on from one train and that the voices are absolutely clear.

New Westminster, B.C.

The city light and power department of New Westminster, B.C., reports a revenue of $35,000 for the first five months of 1918, compared with $34,238 for the first five months of 1917.

Construction has started at New Westminster, B.C., on a modern steel plant. Electric furnaces will be used for the conversion of scrap.

Port Arthur, Ont.

The City Council of Port Arthur have applied to the Railway Board for permission to raise the fares on the street railway. The new schedule is as follows: Adults—Five cents cash fare or one ticket at the rate of five tickets for 25 cents. Children (5 to 12 years inclusive)—Five cents cash fare or 1 ticket at the rate of eight for 25 cents. Under five years of age, free. Good between the hours of 5.30 a.m. and 12 o'clock p.m., and double the above fares between the hours of 12 p.m. and 5.30 a.m. Workmen's tickets will be abolished and the free privileges heretofore extended to Dominion policemen will be cancelled.

St. Stephen, N.B.

Application has been made by the Calais Water and Power Company, St. Stephen, N.B., for permission to establish a new scale of rates for the town of Milton. The company purchase water power from the town of St. Stephen.

Sherbrooke, Que.

Lomis Dakin, Limited, Sherbrooke, Que., have been appointed general contractors for the construction of a distributing station in that city.

Toronto, Ont.

Employees of the Toronto Hydro-electric system, and their families and friends, to the number of about thirteen hundred, held their annual outing at Queenston Heights on July 6. Prominent figures on the judging committee were Messrs. P. W. Ellis and George Wright, of the Hydro commission, and General Manager H. H. Couzens.

Vancouver, B.C.

Employees of the British Columbia Electric Railway went on strike on July 3 for higher wages and shorter hours. Two thousand shipyard employees also struck, refusing to work with machines operated by the "non-union" current of the Western Canada Power Company. It is now stated that providing the city council of Vancouver will agree to an increase in fares the B. C. E. R. Company have agreed to meet practically all the demands made by their employees. The recommendations of the board of conciliation appointed to deal with the dispute, did not prove satisfactory to the employees.

Winnipeg, Man.

Tenders have been recived by the city of Winnipeg for a new 200 kw. generator and switchboard equipment to be installed in the power house of the General Hospital.

Boilers for Immediate Sale

Suitable for shipyards, munition works, mines, mills, elevators, electric power stations, etc.

5450 H. P. of B. & W. Stationary Boilers

with forged steel headers, and superheaters, in the following sizes:—

2—450 h.p. Boilers, 16 wide 12 high, 2 48-in. drums each, installed 1902.
3—590 h.p. Boilers, 21 wide 14 high, 3 42-in. drums each, installed 1905.
3—390 h.p. Boilers, 16 wide 12 high, 2 42-in. drums each, installed 1910.
1—580 h.p. Boiler, 24 wide 12 high, 3 42-in. drums, installed 1910.
2—515 h.p. Boilers, 21 wide 12 high, 3 42-in. drums each, installed 1910.

Eight of these eleven Boilers are now allowed 150 pounds steam, and three allowed 135 pounds. All are in operative condition.

If it is desired to add to the capacity of any modern boiler plant carrying 200 pounds pressure for supplying steam turbines, these boilers can be easily adapted to 200 pounds pressure by being fitted with new drums.

To be sold as they now stand, including grates and the usual boiler connections and fittings attached to them. Purchaser to make his own inspection, to have access to all available records in owner's possession, and to remove Boilers at his own expense.

If prompt possession of any or all of these Boilers is desired, time will be saved by purchaser sending his representative here without delay.

Correspondence desired only with parties who have immediate use for any or all of the Boilers.

Upright closed type feed water heaters, and boiler feed pumps belonging to this plant are also for sale.

WINNIPEG ELECTRIC RAILWAY COMPANY,
WINNIPEG, MANITOBA

LINCOLN MOTORS

Weld and Win

Electric Arc Welding is proving a vital factor in winning the war. Startling evidence of this is accumulating every day.

Lincoln Arc Welders

are now giving the Rock Island Lines 1400 days more engine service per year by hastening their engine repairs. They say that a full equipment of these welders will be equal to the purchase of 23 new engines. And this is only one of many roads using Lincoln equipment.

These welders are saving days of time on vital ship repairs in large eastern dry docks.

They are increasing and speeding up the output of steel castings by filling with molten steel, blowholes, shrinkage cracks and other defects that would scrap 5 to 10 per cent. of the product. Steel castings are absolutely essential in locomotives, steamships, motor trucks and most of all in the actual fighting equipment, cannon, machine guns, rifles, etc.

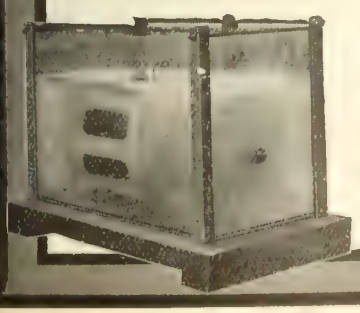
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1	30	3	25	550	1500	T. & H.
1	30	3	25	550	710	Swedish
1	25	3	60	2000	900	C. G. E.
2	25	3	25	550	750	Westg.
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1	½	G.E. NEW..	110	KT	1800
1	½	G.E.	110	I	1800
5	1	G.E. NEW .	220	KT	1800
1	1	Fbks. M. ...	440	B	1200
1	3	Wstgh. New.	220	CS	1130
2	3	R&M NEW.	220		1156
2	3	G.E.	220	KT	1800
1	3	G.E.	220	K1	900
3	3	G.E.	220	KT	1200
1	3	Cr. Wh.	220		1720
3	5	Cr. Wh. ...	220	Q	1720
1	5	Cr. Wh. ...	550	Q	1720
1	5	Wstgh.	220	CCL	1700
8	5	Wstgh. New.	220	CCL	1700
53	7	G.E. (motors only)	550		1200
1	7½-15	Cr. Wh.	220/440		865/1735
2	7½	G.E. NEW .	220	KT	1800
1	7½	G.E. NEW .	220	KT	1200
6	7½	G.E. (motors only)	550	KT	1800
2	7½	G.E. NEW .	220	KT	900
2	10	G.E. NEW .	220	KT	1800
1	10	Wstgh.	220	CCL	1700
1	10	Wstgh.	220	CS	1150
1	10	Cr. Wh. with resistance type starter	550	Q	1800
1	10	G.E.	220	L	1200
1	10	Robbins & M	220	K	1750
1	15	Wagner New motor only ..	440		1165
2	15	Wstgh. New.	440	CS	1155
1	15	G. E.	220	I	900
1	15	Wstgh.	220		1155
2	15	G.E. NEW .	220	KT	900
2	15	Fbks. M.	220/440	KBV	1200
2	20	Wstgh.	220	CS	1165
50	20	Fbks. M.	220/440	KBV	1200
13	25	Wagner..	220/440	KBV	1200
2	30	Wagner New	220		850
1	35	G.E.	220	KT	600
1	35	Triumph.	220/440		900
1	40	Wagner NEW .	220/440	BP	850
1	40	Fbks. M.	220		900
1	35	G.E. NEW .	220	M	900
1	35	Westgh.	220		1170
1	40	Westgh. New	220	CS	870
1	50	Westgh.	220		860
1	50	Triumph	220		720
1	50	Allis-Chal. .	220		1750
1	75	Allis-Chal. .	550		690
1	75	Westgh. New	440	CS	720
1	100	Allis-Ch. . .	550		690
1	100	G.E.	550	K	600
1	100	G.E. NEW .	550	M	600
1	100	Westgh.	440		1200
1	125	G.E.	220	L	600
1	150	G.E. NEW .	220	M	580

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2	5	Wstgh.	220	CCL	705
1	10	Wstgh. New.	220	CS	750
1	12½	G.E.elev.type-high torque	220	KTE	750
15	15	Allis-Ch. . .	220		750
7	20	Allis-Ch. ..	220		750
1	40	Wstgh. . .	220	MW	695
1	50	Allis-Ch. intermittent duty, sl. rg. drum controller	440		500
1	55	Wstgh.sl.rg. 30 cycles, complete. .	440		860
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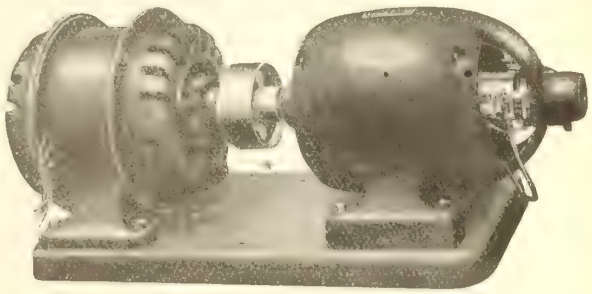
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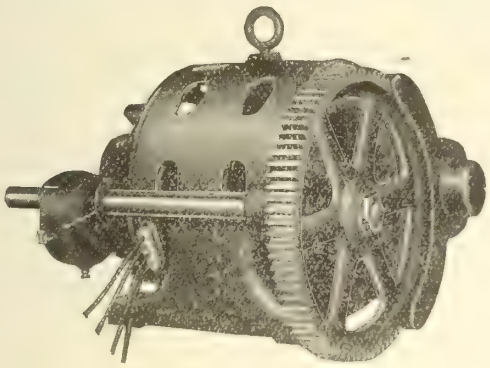
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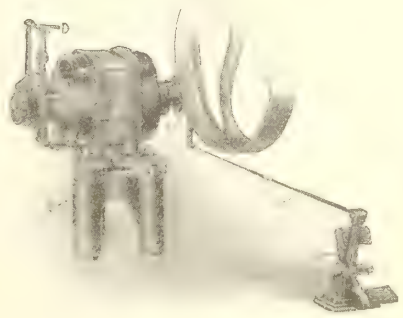
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2	750	West.		220	292
1	275	G. E.	S-1	6600	275

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No.	H.P.	Make	Type	Volt	R.P.M.
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1	300	G. E.	ATL	2300	225
1	300	A. C.	ANY	2200	505
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2—Hydro Electric units, each consisting of one 1200 H.P. double bronze runner, horizontal cylindrical Leffell Turbines, complete with Governors and Draft Tubes. Direct connected to each of these units are two 437 K.V.A., 3 phase, 60 cycle, 4400 volt, 300 R.P.M., G.E. Generators. Equipment is complete with Switchboard, Oil Switches, Instrument Transformers, etc. Equipment practically new.

1—Hydro Electric unit, 1200 H.P., as above, with one 875 K.V.A., G.E. direct connected unit.

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1—800 ft., 30 lbs., Vertical Air Compressor.

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1—200 H.P., Worthington, 2 stage, 12-inch Turbine Pump, rated capacity 4000 G.P.M., at 60 lbs. pressure, direct connected to one 100 H.P., 3 phase, 60 cycle, 440 volt, 575 R.P.M., Westinghouse Induction Motor, complete with auto starter and no-voltage release.

1—1160 ft. Sullivan two stage belt driven air compressor complete.

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MISCELLANEOUS

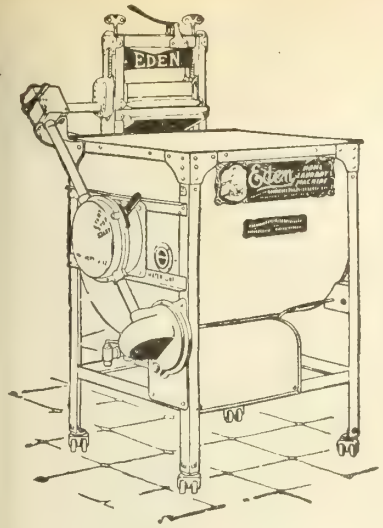
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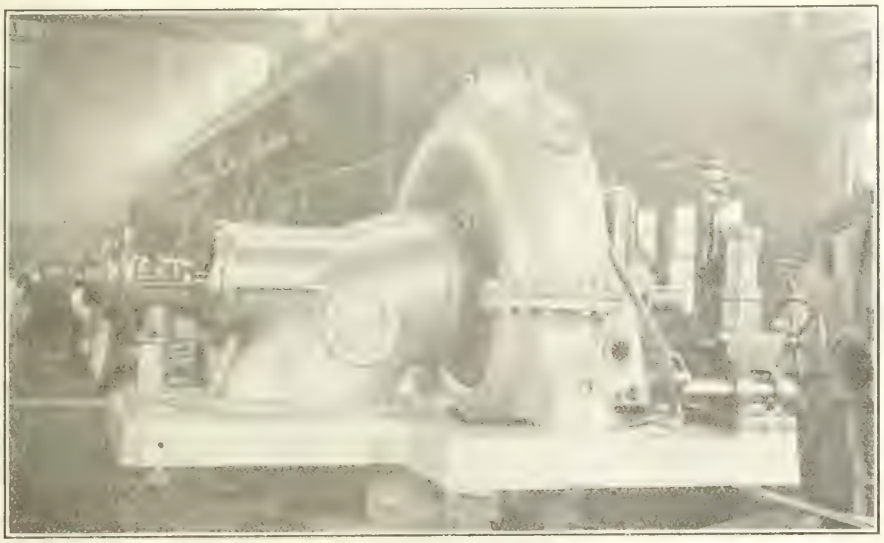
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Why not a Heart to Heart Talk-

THE ORIGINAL SAFETY SWITCH



with the Plant Electrician?

You know in a general way the many advantages of Square D Switches. Your own experience and observation points out the advisability of eliminating the expensive accidents which result from contact with electrical current by replacing open knife switches with Square D Switches.

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Your electrician does. So why not put the Square D proposition up to him? His advice will probably remove the very objections which have made you defer installing Square D Switches.

At least TALK Square D Switches to the electrician—TODAY

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do not hinder production

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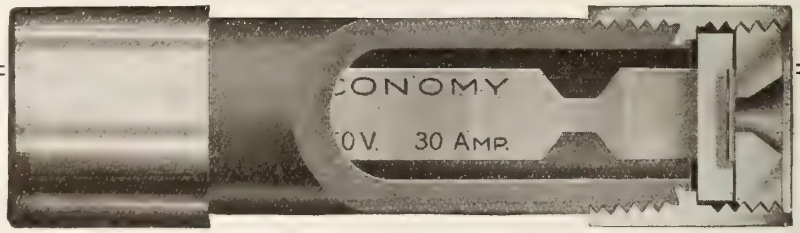
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ALLEN NON ACID SODERING FLUX

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—Any metal to any metal—(including aluminum)

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ELECTRICAL CONDUCTORS

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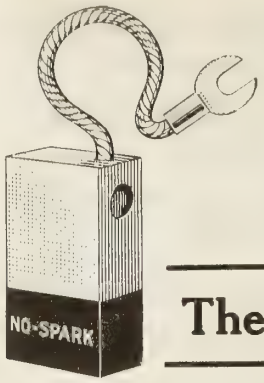
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Built to order

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Kuhlman Electric Co.
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They Don't Spark

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You and your wares may be favorably and nationally known to-day but if you don't advertise you will soon be forgotten.

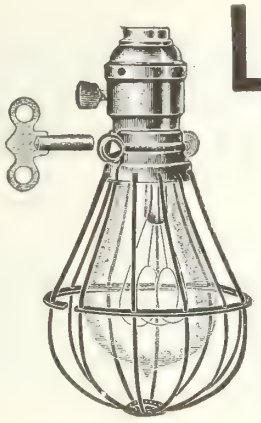
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They can't get knocked out or broken.



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guards give your lamps just such protection.

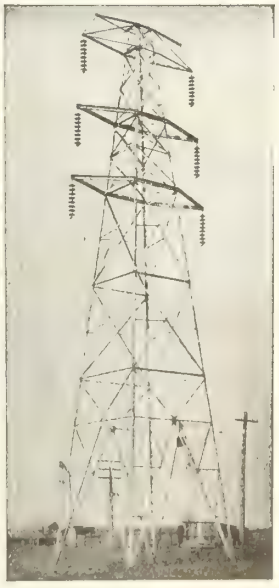
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Standard Tower of the Hydro Electric Power Commission of Ontario

The modern means of supporting overhead wires.

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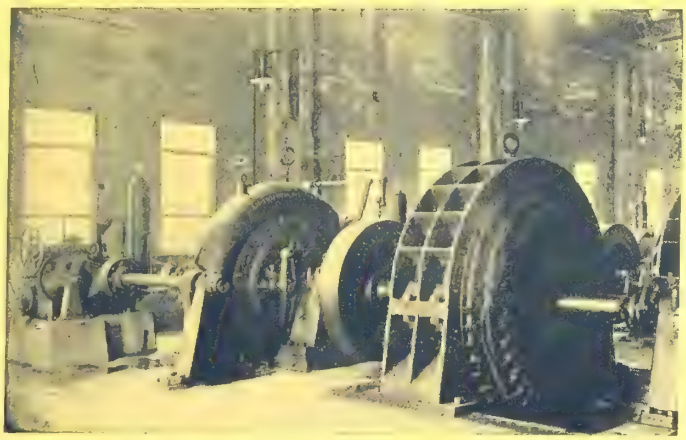
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A Lost Opportunity

As a wiring contractor, how many times have you turned down orders to repair the Motors or dynamos of your customers and let them send their work to the maker?

How much have YOU lost in prestige through not being able to take care of your customers' business?

How much have YOU lost in Profit on this business?



Get the habit of handling these repairs. Send them to a **Specialist in Repairs.** Don't send them to the maker. Your customer can do that, and he's already sick of it. The service is too slow. He wants **quick work** and an **absolutely reliable job. You can give it to him.**

Make up your mind **now.** Say **"I'm going to get something out of the next repair job in this town."**

You have the work of taking out and re-installing the machine **(Profit).** Send us the machine or part with a description of its action or symptom. We'll rush it through for you, give you an A1 job and you come in again on the **Trade Discount (More Profit).**

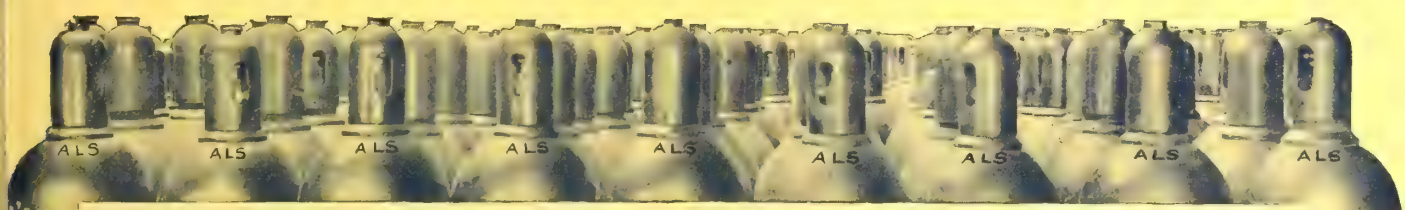
Others are doing it. Why not you? Write about it.

The Electrical Maintenance & Repairs Company, Limited

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"ALWAYS ON THE JOB"

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OXY-ACETYLENE WELDING & CUTTING



A National Necessity

All these parts were reclaimed by Oxy-Acetylene Welding, and the reclamation of one part alone saved at least $150.

More important than this, however, is the fact that they were all restored to immediate service again, thereby obviating the waste of time, labor and material that would result by having to scrap them.

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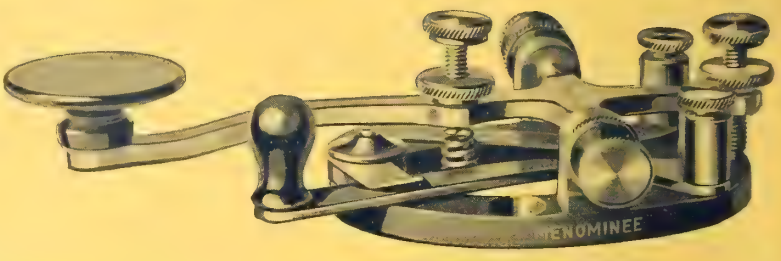
The Pioneers of the Process throughout the world.

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Our make of Telegraphic instruments are in use throughout the Dominion.

We supply everything electrical—Bells Medical Batteries, Fans, etc., etc.



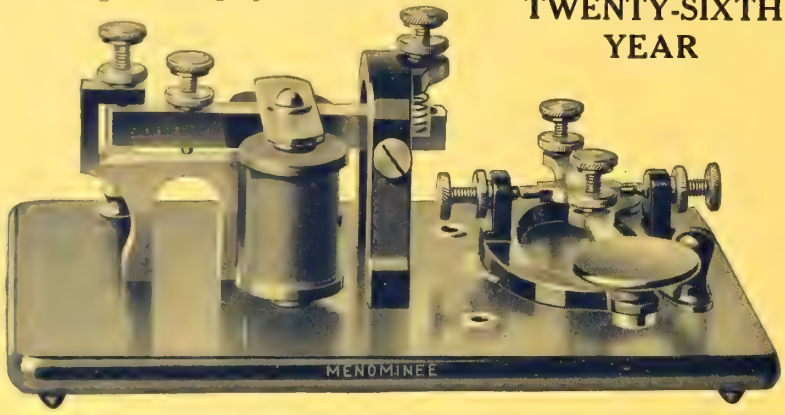
LEGLESS KEY
No. M 100

See above illustration. Polished and lacquered brass base. Nickel plated lever. Coin silver contacts.

SOUNDERS

See illustration below. Nos. 112S and 113S. Black enameled frame. Brass sounding bar and bridge. Mahogany finished base.

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If you didn't get a copy of the new

National Electric Catalogue

write us and we will gladly mail you one.

Our complete line is shown and there is a lot of interesting information in it.

The National Electric Heating Co., Limited

TORONTO, CANADA

Electrical News
Generation, Transmission and Application of Electricity

WHO'S WHO
amongst the Prominent Customers of
Ward Leonard

IT is a significant fact that most of the prominent manufacturers and users of electrical apparatus are *regular* customers of Ward Leonard Electric Company, manufacturer of vitreous enamel insulated resistance units, motor field rheostats, motor starters, motor speed controllers, dynamo controllers, circuit breakers, battery charging rheostats, theatre dimmers, and other forms of controlling devices.

Ward Leonard Electric Company
Mount Vernon, New York

THE DOMESTIC ENGINEERING CO. DAYTON, OHIO, U.S.A. MAKERS OF DELCO LIGHT PRODUCTS
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Best Known Cable Reel In Canada

THE demand for Northern Electric products and the fact that they are made by the largest manufacturers of bare and insulated wires and cables for electrical distribution is a positive assurance of quality.

They are as near perfection in both dependability and durability as experience, workmanship and superior materials, combined with the most modern machinery, can make them.

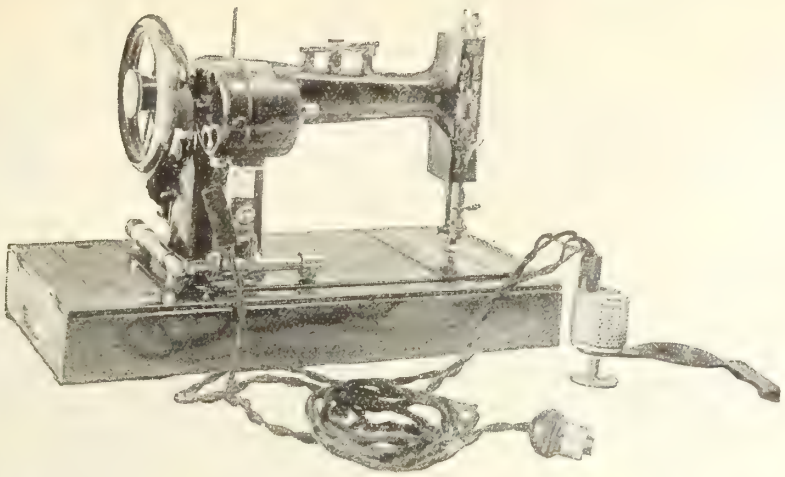
Bare copper, rubber covered and paper insulated, lead covered cables of Northern Electric manufacture—are designed by the most capable engineering skill and tested to ensure safety and efficiency to the fullest degree possible.

Our nearest House will be pleased to submit specifications and prices upon request.

Northern Electric Company
LIMITED

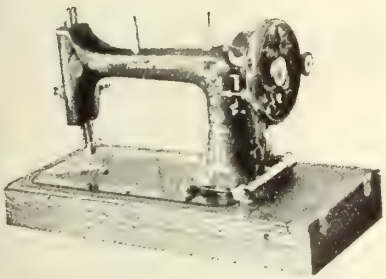
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Elevator Cable
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Flameproof Wire and Cable
Lamp Cord
Lead Covered Cables
Magnet Wire
Marine Wire
Motor Boat Wire
Office Wire
Packing House Cord
Pothead Wire
Paper Insulated Power Cable
Paper Insulated Telephone Cable
Portable Lamp Cord
Rubber Covered Wire
Rubber Covered Cable
Show Window Cord
Signal Wire
Slow Burning Wire
Slow Burning Weatherproof Wire
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Theatre Cable
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Every Woman Needs Its Help—Now

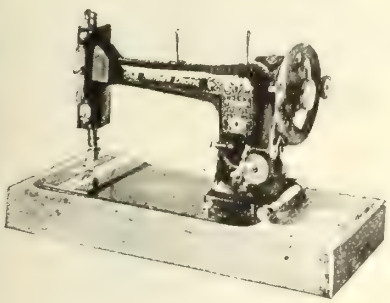
—but when the fall buying season comes, will you be ready?



Why Not Order a Good Supply of

Northern Electric

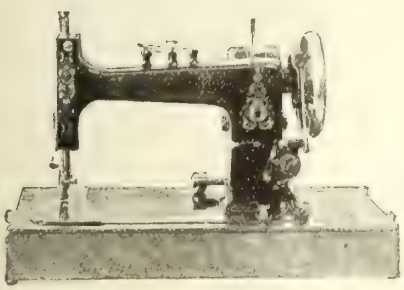
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Remember the greatest need for sewing by electricity is now, when the women of Canada are so extensively engaged in doing their own as well as a large amount of patriotic sewing work at home.

The Northern Electric Sewing Machine eliminates the tiresome, back-aching treadle work of the old method, and enables the operator to do twice as much sewing without effort.

The Northern Electric Sewing Machines are of the highest grade in design and workmanship, and carry a guarantee of complete satisfaction in every way.



Several different types are obtainable in both portable and stand style machines. You can secure either vibrating chuttle or bobbin type.

Closed view of our Portable Type Machines



Write our Nearest House for attractive proposition, descriptive literature, etc.

Northern Electric Company

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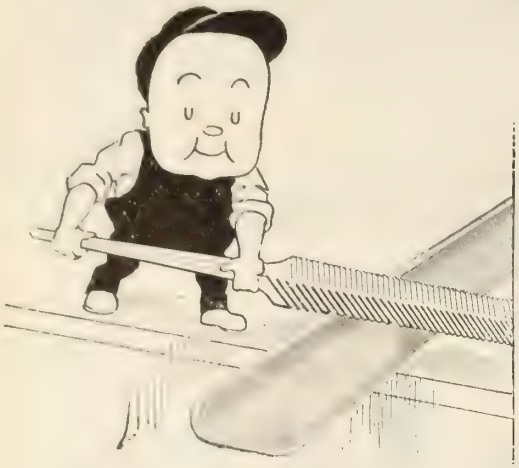
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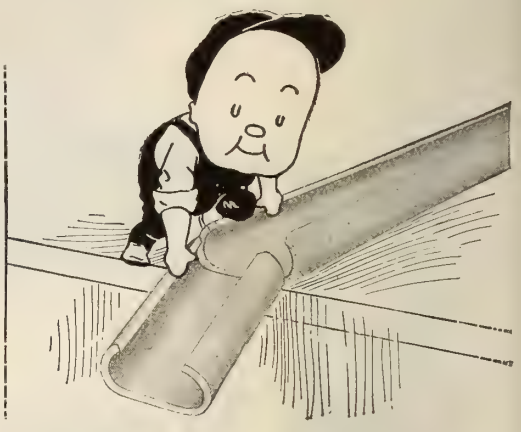
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Nat says—

"Simply notch with a file and break *away* from the edges.

Every other step in installing No. 222 Molding is equally simple."



Lowest Installation Cost of any Metal Wiring System

On your next job refer to your copy of Bulletin 101 and place your order with your jobber.

National Metal Molding Co

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Canadian Distributors—Canadian General Electric Co., Limited

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Made in Canada
Conduit

XCELADUCT

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Toronto

We urge you to use these famous, "better service" Keystone Car Specialties



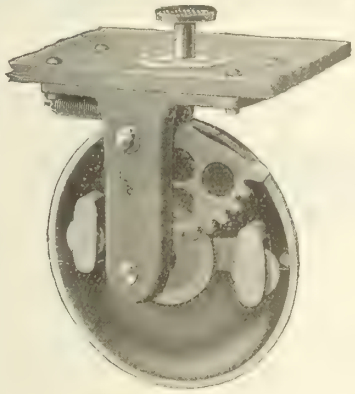
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Operates from line voltage—no batteries. Faraday Push Buttons, Buzzers and Resistances furnish an ideal, failure-proof car signal system.



Illuminated Car Signs

With these signs destination names can easily be changed and cars rerouted. Well labeled cars make more money.



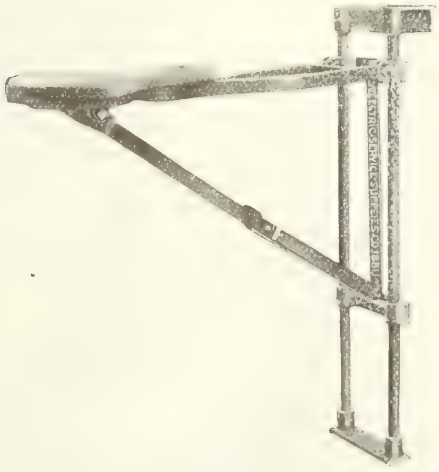
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A louder gong and more continuous to meet requirements resulting from modern, heavy, noisy traffic in cities.



Safety Car Lighting Fixtures

To light up your cars scientifically, efficiently and safely. To save you money.



Keystone Motorman's Seats

For the motorman or conductor. A real collapsable, safe and durable seat. They make operations more contented.



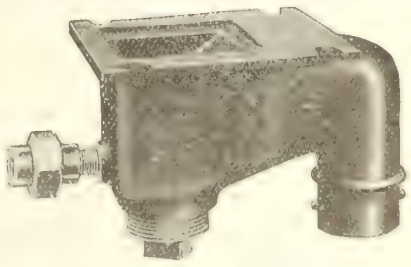
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To light up a path of safety on your cars. Only their famous reflectors can project the distinctive "Golden Glow" light.



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To protect your overhead conductors from "flying" poles thus preventing delays and trouble.



Keystone Air Sanders and Valves

To automatically sand your tracks by compressed air. A real device for safety and accident prevention.

Electric Service Supplies Co.
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NEW YORK — 50 Church St.
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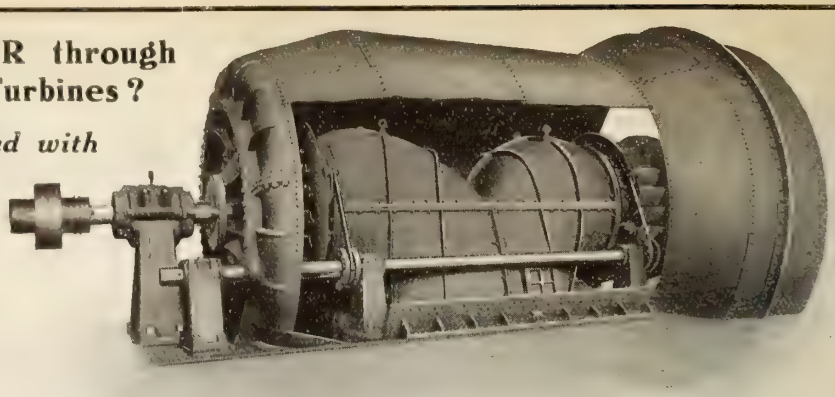
Lyman Tube & Supply Co., Ltd.
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ARE YOU WASTING POWER through Inefficient and Antiquated Turbines?

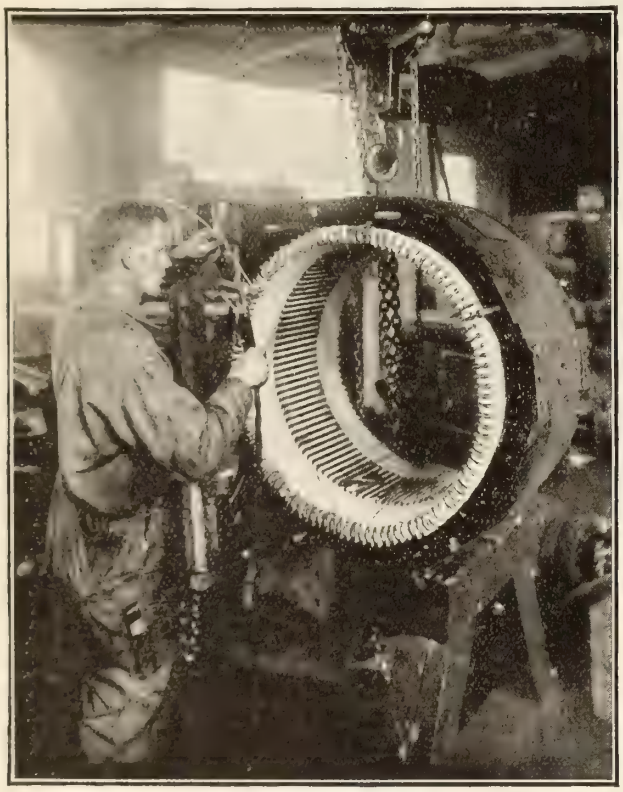
Maximum Efficiency Assured with

"SMITH" HYDRAULIC TURBINES

The accompanying illustration shows a horizontal shaft unit of 2000 H.P. capacity under 42' head. Write Dept. "N" for Bulletin.

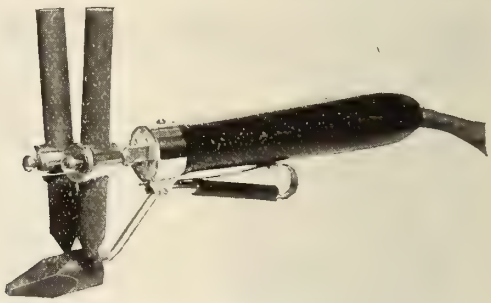


S. MORGAN SMITH CO.
YORK, PA.
H. B. Van Every, 405 Power Bldg., Montreal



50 H. P. Motor Stator Coils Being Soldered with J-C Soldering Iron, in Shops of Robertson Elect. Construction Co., Buffalo.

Save Hours on your Job
with the
J.C. Electric Soldering Iron



The new J. C. Electric Soldering Iron saved 3½ hours on a 5 hour job. The fastest and most economical method of soldering.

Instead of taking 5 hours to solder the terminal leads of the stator coils of this motor the J. C. Soldering Iron cut this time to 1½ hours—a saving of 3½ hours. The secret of the efficiency of this remarkable Iron is the fact that it heats only while in contact with the work, and then heats almost instantaneously.

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Clemens Electrical Corporation of Canada, Limited
HAMILTON - CANADA

For Underground Work

BITUMINIZED FIBER CONDUIT

has properties not possessed by any other type of Conduit made, which recommends it particularly for Underground Systems of Distribution.

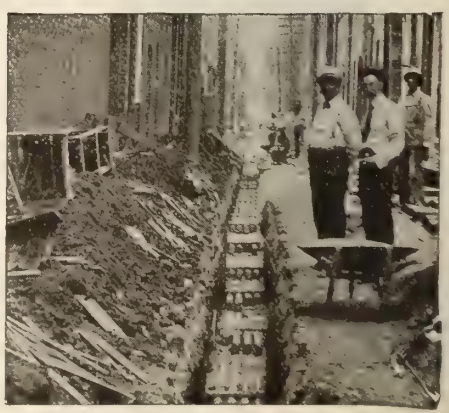
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Absorption, 100 Hours, less than 1 per cent. — Puncture Test 50,000 Volts

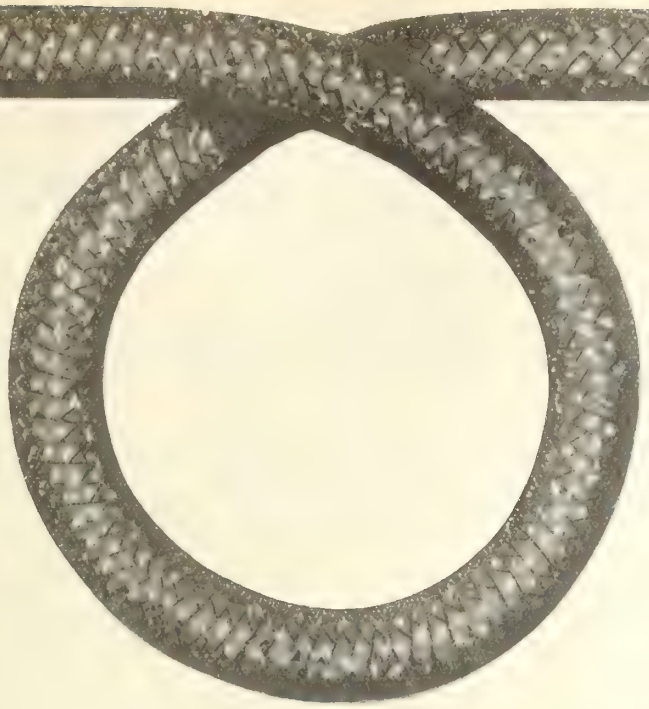
Electrolysis-proof — Water-proof — Gas-proof

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American Conduit Company
East Chicago, Ind., U.S.A. — 140 Nassau St., New York City



Installing a Trunk Line Subway



Kraft Cord "Braiduct"

Made in Canada under Canadian Patent No. 147,057

This cut is reproduced from an actual photograph, and illustrates the behavior of the material in this rigid test—perfect flexibility. We cut the ends to show plainly the superior construction—note the high grade Canvas Duck Lining and the KRAFT CORD winding. This KRAFT CORD is made to our own specifications and is fire-proofed, which is entirely new.

KRAFT CORD "BRAIDUCT" is in a class by itself—superior to any imported conduit—is absolutely the last word in flexible non-metallic conduit construction.

We are now making our own insulating compounds, consequently every lot will be uniform in flexibility, and every foot is fished at the factory.

KRAFT CORD "BRAIDUCT" is easy to instal—easy to cut—easy to secure, as it is made in our own country, and easy to buy, as our price is right

KRAFT CORD "BRAIDUCT" is regularly inspected and labelled by the **Underwriters' Laboratory** under the direction of the **National Board of Fire Underwriters** and every coil carries their label.

We will be glad to send you a sample.

The Flexible Conduit Co.

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Guelph - Canada

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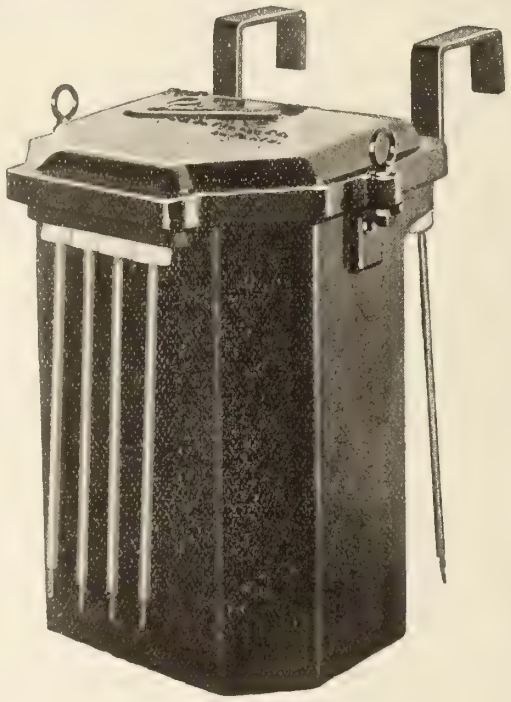
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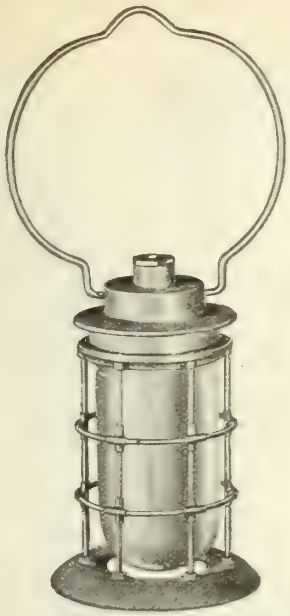
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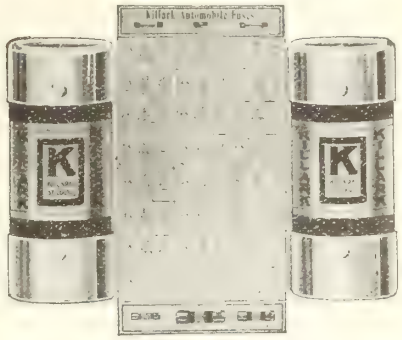
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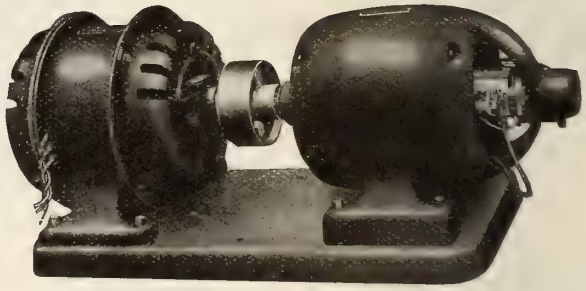
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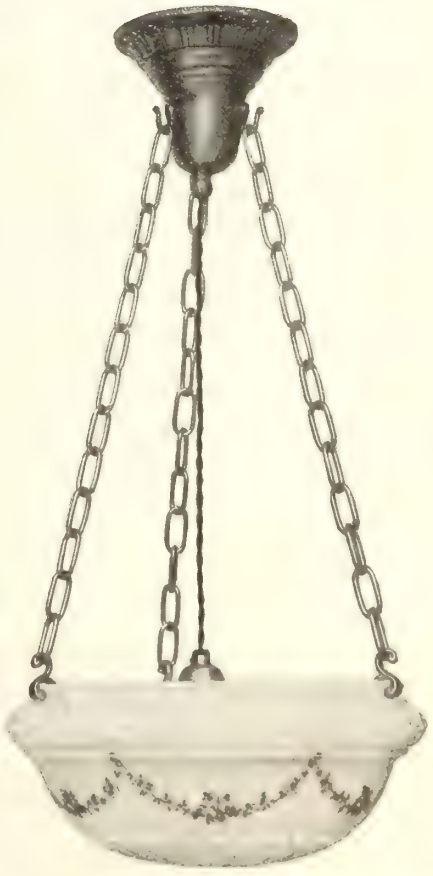


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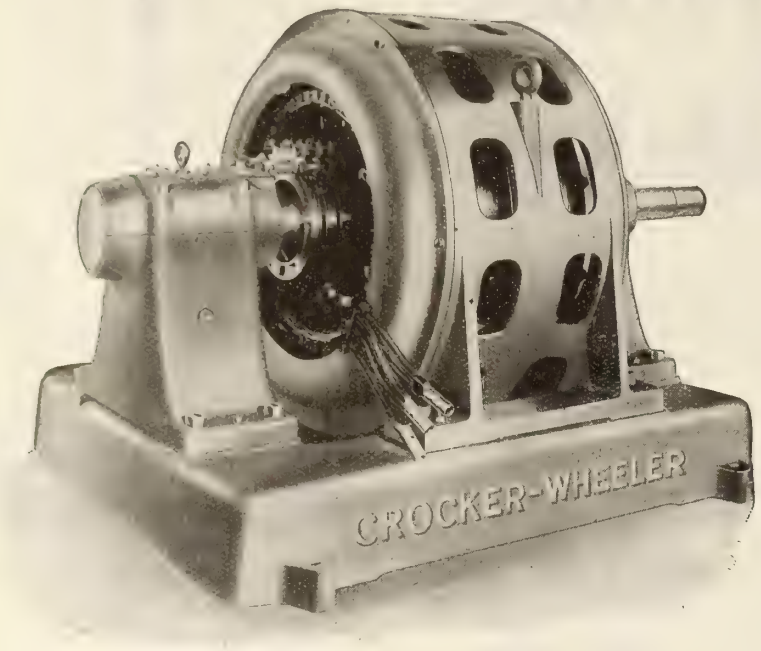




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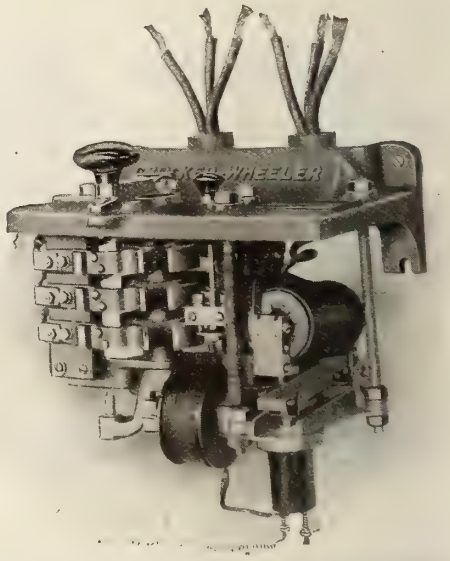
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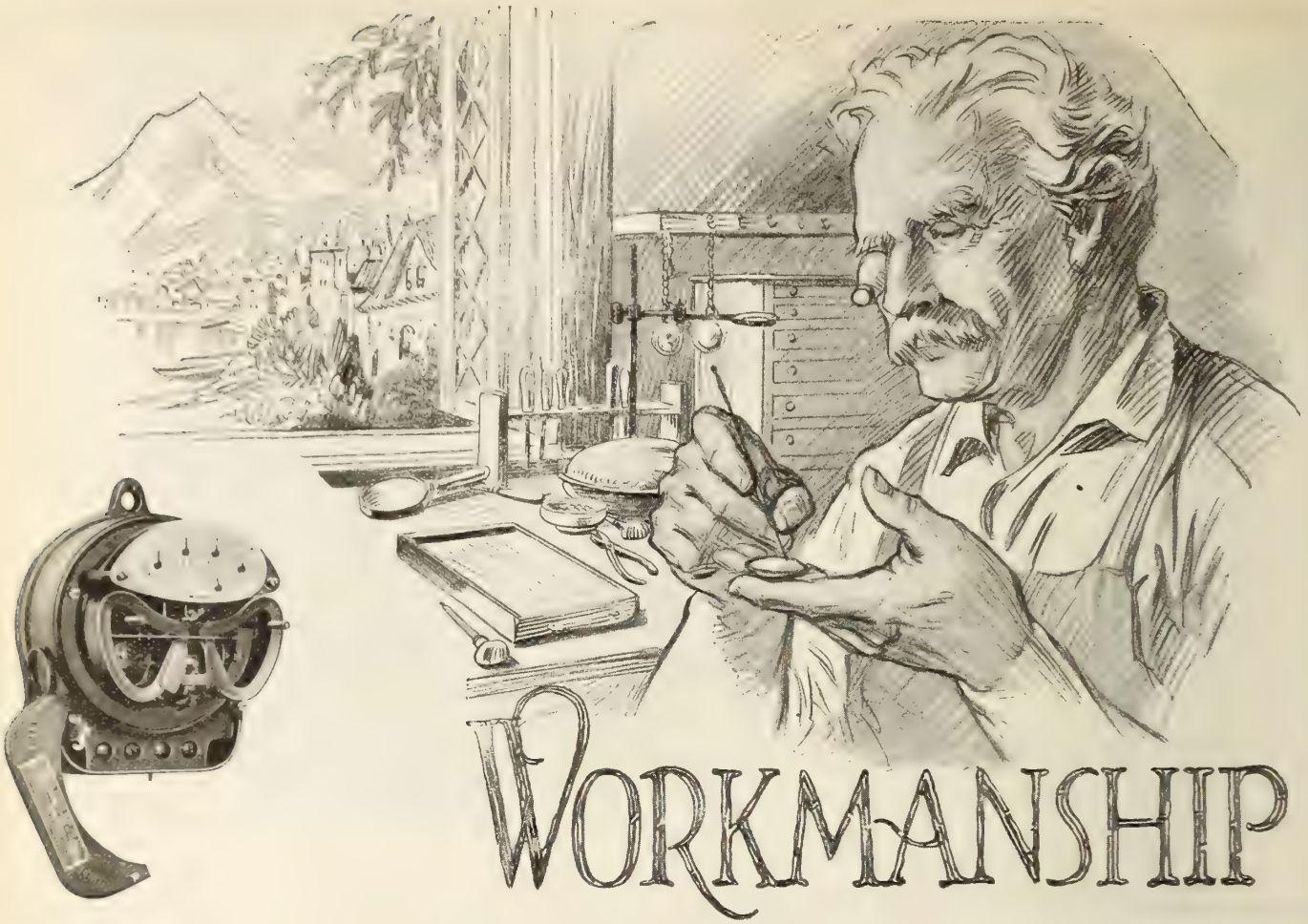
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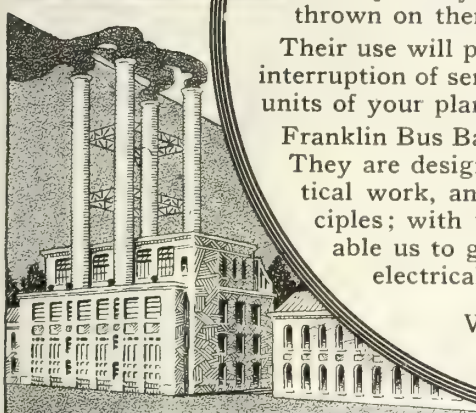
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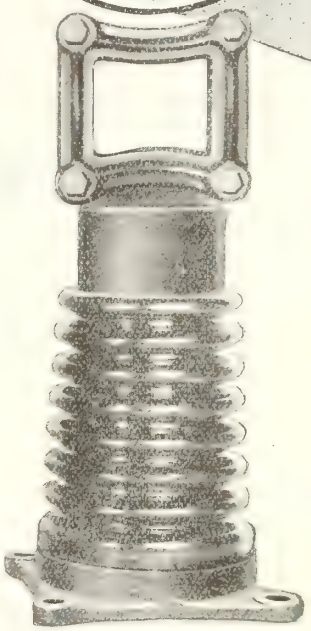
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Their use will protect you and your customers against interruption of service, no matter what other individual units of your plant may break down.

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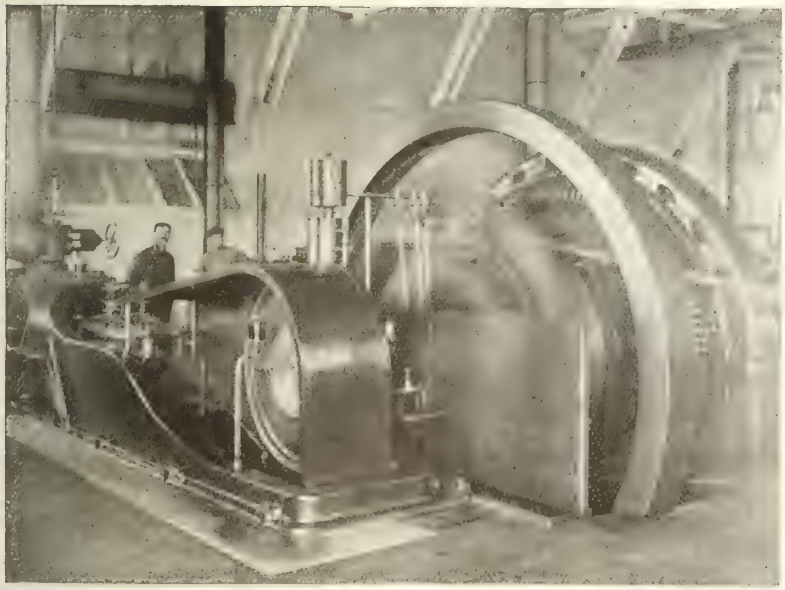
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1—12 x 24 x 30 Wheelock Tandem Compound Engine

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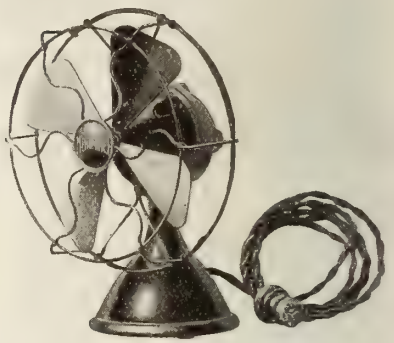
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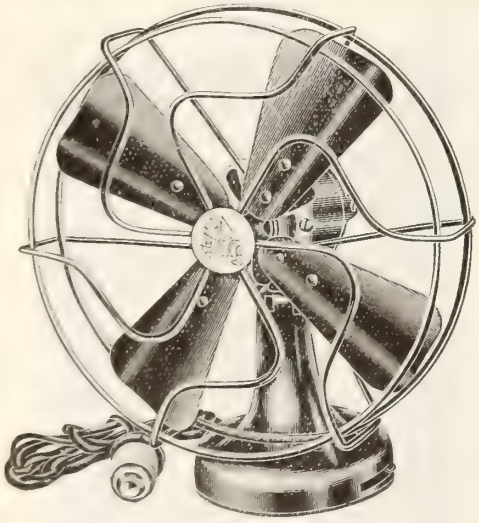
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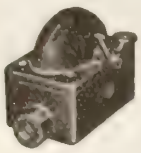
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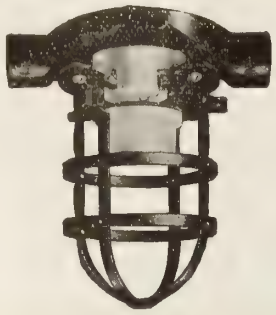
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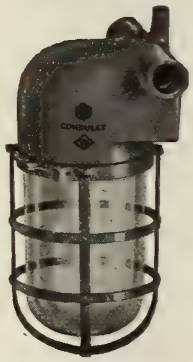
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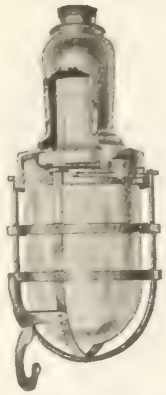
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Vol. 27 Toronto, August 1, 1918 No. 15

Value of Resuscitation Methods Should Be More Generally Known

A few days ago an accident occurred on the work of the Toronto Harbor Commissioners, whereby one of the employees received an electric shock which resulted fatally. There were a number of other workmen in the immediate neighborhood and resuscitation methods were promptly employed. The men claim that their efforts were just meeting with success and that there were actual signs of returning consciousness when a policeman came along and insisted that the work be stopped. The policeman telephoned for an ambulance and the injured man was taken to the hospital. The policeman later claimed that the workman was dead before he arrived.

The greatest difficulty is invariably encountered in forming a judgment as to whether a man might have died who has actually been resuscitated, or whether a man might have lived had resuscitation work been commenced earlier or carried on longer, or been followed out in a different way, but in the present case there seems to be a reasonable probability that the arrival of the policeman on the scene was the cause of this man's death. At least, it was manifestly unwise to take time to remove the injured man when a few seconds might mean all the difference between life and death. There is every possibility that the man may have been just on the point of recovering and that continuation of resuscitation work may have brought him around in due course. However, the policeman arrives—an all-powerful authority—and orders the work discontinued.

It is another example of what electrical men in particular have to contend with in connection with their resuscitation work. In spite of the fact that Ontario has now been fairly well covered by a resuscitation expert who has given actual demonstrations to practically every operating company and every municipality in the province of Ontario, the results so far do not appear to have gone beyond the electrical operating men themselves. It looks as if it would be necessary to start out on a new tack. Whatever experience this unfortunate man's fellow employees may have had in resuscitation, or whatever their knowledge of the most approved process may have been, any policeman, who lacks this information, appears to have had the power to prevent the work being carried on. Either it will be necessary, therefore, to keep such officials off the ground when an accident happens, or, which seems to be the better practice, these men will have to be trained and educated so that they may intelligently cope with the exigencies of such an accident.

The biggest difficulty lies in the uncertainty which arises out of the whole situation. It has never been possible, and never can be, to say absolutely, when a man has been resuscitated by this or that method, that he would have died without it, but there is evidence enough to convince those who have made a study of the various methods that these are of great value and that, under ordinary circumstances, there is one best method. There is also evidence to show that these methods have resulted in restoring a man after very considerable periods, and it is recommended that work should not be discontinued inside of a couple of hours unless there is unmistakable evidence that the man is dead.

We hope this particular case will be given so much publicity that it will be brought to the attention of those who are primarily responsible for the apparently unwarranted action of this policeman, so that there may be no future recurrence of such a fatal mistake.

Vancouver Operators Guilty of Indefensible Tactics

The placing in jeopardy of so essential a public service as light, power and electric transportation by the action of a body of men who acknowledge no responsibility to the public, is, we believe, a situation which should not be allowed to pass without all possible publicity. During the last few weeks, an unprecedented state of affairs has arisen in Vancouver due to the action of the operators of this company's power plants and sub-stations in wilfully attempting to close down all electrical supply as a means of enforcing their demands regarding wages and other alleged grievances. This occurred at midnight on Saturday, July 13, without notice being given to the company or the public.

The agreement between the B. C. Electric Railway Company, the Western Power Company and the B. C. Telephone Company, respectively, and the electrical workers, expired on June 30. Previous to that the men laid a new agreement before these companies, embodying many drastic changes. The two first named offered the men increases of 10 per cent., but this was refused. Accordingly a conciliation board under the Lemieux Act of Canada was proposed, but again the men refused, thereby necessitating the Dominion Government naming an arbitrator for them. The conciliation board was formed, but the electrical workers refused to recognize it.

In the meantime, an arbitration with the street railway men employed by the B. C. Electric Railway was going on, but its sessions did not close until June 28, and no time was left in which to bring down a decision before June 30. The men in both unions decided to go on strike at midnight, July 1, in contravention of the law of Canada.

It is believed that the electrical workers fully intended that Vancouver and the surrounding country should have been

without light or power on their going on strike, but the electrical superintendent and some seven or eight of his assistants, maintained the service in a score of sub-stations scattered over the mainland. No inconvenience was occasioned except by the absence of street car service, partly because the street car men were on strike and partly because the handful of men could not keep the rotaries in operation.

On Thursday morning, July 11, about 1.10 o'clock, the company came to a settlement with the two unions and agreements were signed. Service resumed the same day. It was believed that the matters at issue had been finally settled with the exception of one or two minor details, such as free transportation and a lighting rate concession which had, by consent, been left to be adjusted later.

Struck Again After Settlement

The astonishment of the whole district, the management of the company included, may be judged when a few minutes after midnight on July 14, suddenly, and without warning, all lights, power, street cars and interurban cars fed by the B. C. Electric system stopped. Thousands of persons were around at this hour. Street cars were loaded. Interurban cars were miles from their destinations. One car with 60 passengers and another with about 70 persons in it was stalled at New Westminster, unable to proceed along the Fraser Valley division. Other interurban cars were stalled on the Lulu Island and Burnaby lake lines, each with passengers in them.

The effect of the stoppage of light and power in hospitals and cold storage plants need not be emphasized. It is evident, however, that the men intended to make the tie-up complete, because not a switch was left in place in the main receiving station. The electrical superintendent arrived there within a few minutes and found a large group of linemen and operators around the station. Luckily he had an electric torch in his automobile, for without it he would hardly have been able to make his way through the station. There was not a lantern left. The sub-station had been deserted.

All that the company were able to ascertain was that the operators had received orders from someone unknown, not the load despatcher, to close down the plant. The operators at the Lake Buntzen hydro-electric plant were telephoned to and they threw off the machines there. All switches throughout the country were pulled, thus entailing a tremendous mechanical task to reinstate them.

Superintendent Newell immediately got in touch with Lake Buntzen and aroused the superintendent there, who had retired for the night. Other engineers arrived, and in forty minutes the most of the city load had been picked up, and an hour and a half later most of the railway lines were operated and cars were able to proceed to the barns. Many of them finished their own runs.

An attempt was made to arrive at the cause of the trouble, but communication with E. H. Morrison, business agent for the electrical workers, could bring no coherent account. Mr. Morrison intimated finally that they would not meet the company in any way unless the electrical superintendent was discharged. On Sunday morning, Mr. Morrison called up and asked if this had been done, and when he was told that it had not, he refused to have further communication with the company. He mentioned that other unnamed officials would have to be discharged also. It has been stated in the newspapers that the men's union have cabled to the directors of the company in London, England, demanding the dismissal of the electrical superintendent.

Employees Were in the Wrong

On Sunday, July 14, members of the board of trade and Mayor Gale formed a committee to endeavor to bring about a settlement. Street cars were again tied up, owing both to the scarcity of current and to the refusal of the men to work while the electrical workers were on strike. A joint committee was formed having on it several labor representatives and the company laid its case before them. The men demanded transportation and lighting concessions, and although the company pointed out that these had never come up, they granted them forthwith. The men alleged that 25 men had been dismissed in discriminating fashion and strike breakers kept on. Mr. W. G. Murrin, assistant general manager, showed clearly that the men who had been laid off were linemen and groundmen and were extra staff that had been working on special work which the company expected to lay off several weeks since on the completion of the work. These men were laid off strictly according to the length of their service and not a single non-union lineman or groundman was in the employ of the company. The men demanded the dismissal of Mr. Newell, but it was pointed out that these 25 men had not been laid off by him, but by the foreman in the regular course of work. The company, however, agreed to place the case of the electrical superintendent up to arbitration while the electrical workers should go back. This solution was accepted by the joint executives of electrical workers and street railway men, who promised to recommend it to their members. The street railway men met on Monday and car service was resumed the same afternoon. The electrical workers met on Monday night but refused to carry out the recommendations of their executive and demanded the dismissal of the superintendent immediately.

The arbitrary attitude of the electrical workers is without precedent in this country. We believe that they will be censured without exception for their deliberate attempt to tie-up the life of Vancouver and district when they shut down all electrical supply without warning or notice on the morning of July 14. This has ceased to be a matter between the B. C. Electric Railway and the employees. It is a matter for the public and for governments to settle—whether they will allow any person or body of persons to close down such essential services as electric light and power without a moment's notice and without responsibility for the consequences. The men may have the right to cease work, but they have not the right to tamper with the company's property, thereby inconveniencing thousands of persons and causing destruction of property and death.

Hydro Development at Armagh

A small hydro-electric development is in course of construction at Armagh, near Levis, P.Q., from plans by Messrs. Gauvin & Beauchemin, consulting engineers, Quebec. The water power is on the Armagh River, and it is proposed to develop 400 h.p. as a minimum. The plans provide for the erection of a concrete dam, 81 feet high, with a concrete power house 20 x 30 feet. The wooden penstock will be 450 feet long. Two 180 kw. generators, supplied by the Canadian Fairbanks-Morse Company, will be direct connected to horizontal turbines, made by the William Hamilton Company, Peterborough, working under a head of 88 feet. The power will be used for manufacturing purposes. The Canada Electric Company, Montreal, are the contractors for the electrical equipment.

The Dominion Railway Board has granted the Hamilton Railway Company permission to increase their passenger rates subject to the limitations created by municipal franchises. So far as the town of Burlington is concerned, therefore, there will be no change, although the fare to intermediate points may be increased. There is no agreement in the town of Oakville covering radial fares, and increases at this point will no doubt go into effect shortly.

Incorporation has been granted to the Globe Electric Company of Canada, Limited, Winnipeg, as a joint-stock company. The capital stock is $100,000.



Front show window—Interior lights on, window off.



Front show window—Interior lights off, window on.

London Hydro System in New Building

The London Hydro-electric Commission have just moved into a fine new administration building, some features of which are illustrated herewith. It will be seen that the commercial end of the enterprise is exceptionally well taken care of, for it is doubtful if more beautiful and attractive demonstration and sales rooms are to be found anywhere in Canada. One of the views shows the interior of the main room; another shows a section of the basement. In this latter the lighting arrangements are particularly good; the majority of the light is obtained from artificial windows in the wall shown at the right hand of the photograph; this is a false wall and behind it are mounted numerous lamps, the light of which is directed outward against the real wall and reflected back into the basement through ground glass window glass; the reflecting wall is painted sky blue, so that the final effect is that of an almost perfect daylight. The photograph shows that the distribution is as good as could be desired, there being practically no shadows.

The other two photographs are exterior views of the show windows. In one of the photos the window lights are off and the interior lights on, and in the other window lights are on and the interior lights off. This latter picture demonstrates the very good effect obtained by means of window lamps concealed in the archway above the window with prism glass mounted along the under side of the arch.

The foundation of the building is concrete, with the superstructure in gray Indiana limestone. The partitions are of gypsum block; wire glass windows are used in all partitions. The floor of the main room, shown in the photograph, is tile, and the finish is Laurentian marble. Steel trim is used throughout, treated to imitate Circassian walnut. The only wood used in the building is said to be the top of the counters. The stairs leading from the first to the second floors are also Laurentian marble.

General Manager E. V. Buchanan, who is largely responsible for the planning of this fine building, states that it is modelled to a very considerable degree on the New York Edison Company's plan, though, of course, on a smaller scale. The building is approximately 50 x 90 feet, three storeys and basement. In the meantime the third storey is being oc-



Interior Main Business Office—London Hydro.



A section of the basement—Lighted through a false wall.



New Administration Building of London Hydro System.

opened on July 10, when invitations had been widely issued by the government to Hydro supporters throughout the province.

Fire Loss in Canada Greatest in World

A report just issued by the Commission of Conservation on the fire waste of Canada shows us up in a very unenviable light. The fact is that **our fire loss, per capita, is the greatest in the world,** amounting to approximately $3.00. This is a big load for every man, woman and child to carry and seems all the heavier because it is unnecessary and unreasonable.

Of course, it is useless to argue that this loss is borne by the insurance companies. It all comes out of the people—directly out of those who pay premiums and indirectly out of those who do not, for fire means a national loss which is shared by all. And the property loss is not all—there is the inconvenience, the loss of business, of revenue, of wages—all clogs in the wheels of our national industries. And to think that much, very much, of this is due to sheer carelessness! The report summarizes the results of the Commission's investigations and offers recommendations for remedying the unsatisfactory conditions:

General Conclusions

1. That the annual loss of life and property by fire in Canada—the latter averaging $2.73 per capita annually for the years 1912-1915—is greater per capita than in any other country in the world, and constitutes an enormous and increasing drain upon the resources of the Dominion, besides most seriously affecting the economic prosperity and general well-being of the people.

2. That such losses can be very materially reduced. This is clearly shown by the experience of European countries which have attacked the problem at its source.

That the loss by fire is chiefly ascribable to

(a) Carelessness due largely from a sense of security created by the present system of fire insurance.

(b) Faulty building construction.

(c) Arson.

(d) Lack of adequate fire prevention laws, such laws as exist being poorly enforced.

4. That, for immunity from the danger of fire losses, the people of Canada are relying largely upon elaborate and expensive systems of fire-fighting and are giving too little attention to the prevention of fire.

5. That our fire departments, while among the best in the world in both apparatus and personnel, are not preventing the steady growth of losses.

6. That the monetary indemnity provided by fire insurance does not restore the values destroyed, but merely distributes the loss, through the channels of commerce, over the whole people.

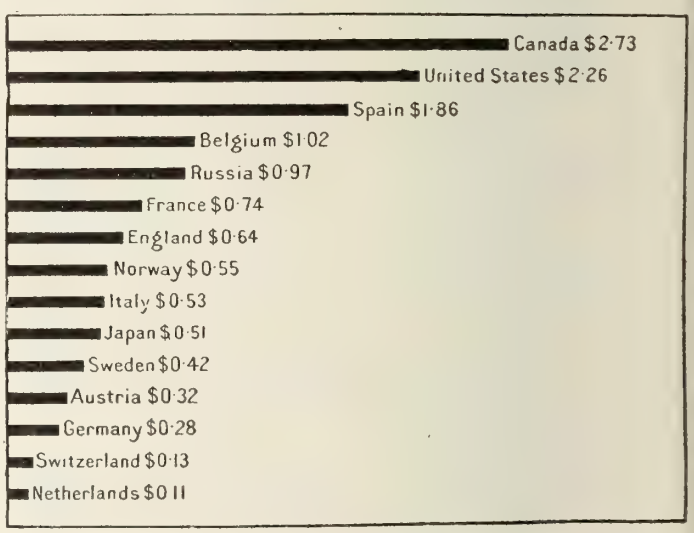
7. That the cost of fire insurance and fire prevention is, in a large measure, determined by the amount of the fire loss and cannot be expected to decrease except as the fire waste declines.

8. That, although the aggregate loss by fire constitutes a national problem, all fires are local in origin and are, therefore, locally preventable and controllable.

9. That property owners generally have not been sufficiently influenced by their own interests or the welfare of the country at large to use effective means to correct fire-waste conditions.

10. That existing legislation respecting the prevention of fire is inadequate and lacking in uniformity.

11. That such legislation is almost entirely confined to



Annual per capita fire loss in Canada and other countries.

cities and more important towns, and that the dangers and hazards of fire in small communities and rural districts are without regulation or control, despite the occurrence of a large proportion of the fire waste in rural districts.

12. That the only possible solution of the national fire-waste problem lies in the adoption of compulsory measures which, by reducing to a minimum the fire hazards in all communities and properties, will prevent the occurrence of fires.

13. That, owing to the failure of local authorities to deal adequately with the situation, the provincial governments should undertake the removal of a burden imposed upon the whole people and should safeguard the lives and property which, in the final analysis, constitute the true wealth of the country.

Government control of the telegraph, telephone, cable and radio systems in the United States was put into effect on July 31. Authority to operate the lines is vested in the postmaster-general.

The Oxide Film Lightning Arrester

By Crosby Field*

This paper will be confined to a brief statement of the scientific principles underlying a new type of lightning arrester called the "oxide film arrester." The functioning of this arrester depends upon the fact that certain dry chemical compounds can be changed with extreme rapidity from very good conductors of electricity to almost perfect non-conductors by the application of a slight degree of heat. Lead peroxide is a good example of such a substance. It has a specific resistance of the order of one ohm per inch cube. The resistance varies with the pressure to which it has been compressed. At a temperature of about 150 deg. cent. the lead peroxide (PbO_2) will be reduced to red lead, commercially known as minium (Pb_3O_4). This has a specific resistance of about 24 millions ohms per inch cube. At slightly higher temperatures this minium will be reduced through the sesquioxide (Pb_2O_3) to litharge (PbO), which last named is practically an insulator. [A megger reading of infinity is obtained on a column 3 millimeters long (0.11 in.) and 5 square millimeters area (0.2 sq. in.)]

Again the oxides of bismuth give similar characteristics. There are, furthermore, several other compounds and mixtures of compounds that will give these same results.

Lead peroxide is normally in the physical state of a powder. If this powder be placed between two electrodes and a current passed, the temperature due to the resistance at the contact of the peroxide and the metal will cause heat to be generated locally at the surface. When this heat is sufficient to create a temperature of about 150 deg. cent. a film of the lower oxides of lead forms, producing a film of insulation which stops the current. This method of film formation over any large area is rather irregular, and of course the oxide is not used in such a fashion in the commercial arrester. Instead of this formation of litharge film any insulating film may be put on the electrodes initially. As insulating film spread on the metal plates there have been used thin layers of the following: glass, water glass, halowax, cloth, balsam, shellac, oil, paints, lead paints, varnishes, and lacquers of all available kinds. In all cases the results are similar, varying only with the voltage at which puncture of the film of insulation occurs.

The foregoing statements define the principle of the commercial oxide film arrester. It comprises two sheet metal electrodes set about 0.5 in. apart, one or both covered with a thin insulating film and the space between the plates filled with some such substance as that described above as, for example, lead peroxide. At a permissible voltage of 300 volts per cell the insulating film prevents any appreciable current flowing under normal conditions. As soon as the voltage rises slightly above normal the film punctures in one or more microscopic points, the lightning charge meets with practically no resistance and flows to earth, Fig. 1. The dynamic current starts to follow, but because of the fact that the insulation was punctured in such fine points, the current density near these points is exceedingly great. This results in a localized heating which speedily raises the temperature to a value sufficient to change to insulating litharge all the conducting peroxide in this minute path of the current flow in contact with the electrodes. The film consequently reseals, stopping the further flow of dynamic current. This action is so rapid that its duration cannot be measured on an oscillograph giving two thousand cycles per second, that is to say, the action of resealing occurs in less than one four-thousandth part of a second after the excess of lightning voltage has ceased.

Fig 2 shows a magnified, imaginary representation of one of the films on one metal plate. As shown, the film is punctured by a spark and filled with a litharge plug which is represented by the open circles. The cross-section in the discharge path, a short distance away from the metal electrode, is sufficiently expanded to make the current of low enough density not to heat the peroxide to a temperature of reduction to litharge. The peroxide is represented by the solid dots and only those in the path of the discharge are shown. At the other electrode, not shown in this magnified diagram, a similar effect may be taking place, although there is a difference between the positive and negative crators.

This film can be made of litharge itself, as well as any of the insulating materials above named. For example, metal plates may be inserted in any of the well-known lead electroplating solutions, and thus a very thin lead peroxide film (measuring a few hundred thousandths of an inch) formed. By proper heating this will be changed to litharge and this form of electrode can be used. Peroxide may also be sprinkled over any metal plate and the plate heated, which will reduce the peroxide to litharge. Again, the metal chosen for the electrode itself may be lead and if heated in the air a thin film of litharge will be formed on the surface. Again, an aluminum electrode may be put in any of the common electrolytes, and a thin aluminum film be built up. This may be used with the peroxide powder. Of these methods of forming the film the most preferable is by dipping in varnish or lacquer highly burnished surfaces of brass, steel, or copper, and is consequently used in the commercial arrester. The ohmic resistance of the arrester during discharge is quite low (less than 1 ohm per cell). Thus, when the insulating film is punctured the arrester offers very slight impedance to the flow of energy at abnormal voltages.

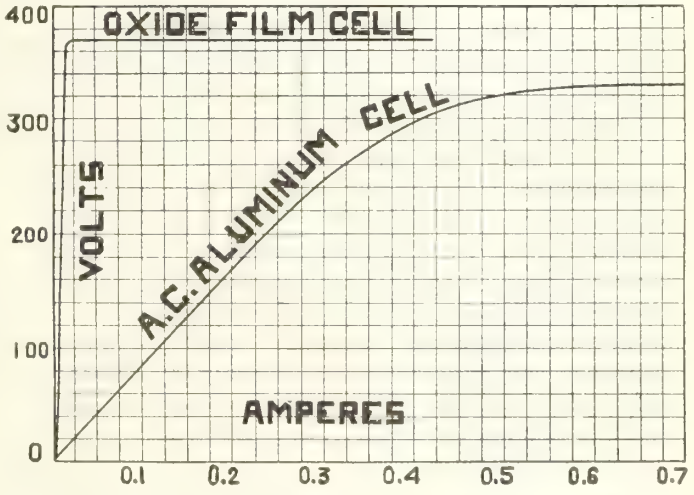


Fig. 1. Comparative Characteristics of Oxide and Aluminum Cells

There is a certain range of voltage necessary to pierce any given insulation. The exact voltage depends not only upon the thickness of the insulation and its dielectric strength but also on the relation of the dielectric spark lag to the duration of the super-spark potential and the frequency of alterations of the transient surge.

If an arrester is to give protection of insulation in shunt

*Before the A I.E E. Convention

with it the arrester must relieve the abnormal electric pressure before damage is done to the insulation. Although tests are frequently made with the arrester and the insulation (it is to protect in parallel, a more convenient method has been standardized and is known as the equivalent sphere gap test. Both the insulation and the arrester are compared by comparing each to the equivalent sphere gap.

The equivalent sphere gap of the oxide film arrester may be analyzed, as in other cases, into separate and distinct parts. First, there is the equivalent sphere gap of the main gap to initiate a discharge through the insulating film on the plate surface of the cell. Third, there is the equivalent sphere gap of the resistance drop of the current discharging through the powdered peroxide in its path. Fourth, there is the equivalent sphere gap of the inductance of the arrester.

Commenting on these factors in their relation to this

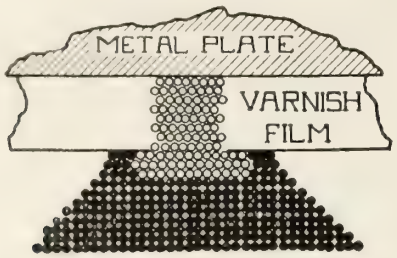


Fig 2. Imaginary representation of Oxide film on one metal plate

arrester, the main gap is itself a sphere gap which has the fastest spark of any practical gap. The gap setting, like that of the aluminum arrester, is only slightly above that of the normal voltage of the circuit.

The equivalent sphere gap of the film is several times greater than the thickness of the film because solid material has a greater dielectric spark lag than air, but with this multiple of the thickness of the film the equivalent sphere gap is still low. Since peroxide is a good conductor, the series resistance in the path of the discharge is insufficient to give an undesirable voltage drop. As to the inductance of the arrester, it has a minimum value due to the fact that each cell is only 0.5 in. long, and these cells are placed one on top of another. In other words, the total length of the arrester (which constitutes the inductance) is short as compared to the necessary length of conductor from line to earth.

One of the obstacles that had to be overcome in the making of this arrester was the increase in the resistance after a great many heavy discharges had passed through it. The predominant reason for the increase seems to be explained by the following theory. The current passing through this small puncture in the film heats up very rapidly not only the powder but also the air contained within the interstices of the powder. The particles are thereby thrown out of contact with each other, thus producing a fluffiness. The decrease in the number of contacts decreases the actual cross sectional area of conduction and hence increases the resistance. This raises the equivalent sphere gap. This action is accelerated, of course, by the giving off of the oxygen itself evolved in the reduction from lead peroxide to the lower oxide. If, however, this same arrester be violently jarred or the filling powder be compressed, or any other method utilized to restore the particles to their previous intimate contact, the equivalent needle gap will fall again. While increased fluffiness appears to be the predominant cause of change of the equivalent sphere gap, the increased thickness of the film of litharge at the point of puncture of the film is finally a factor of moment. The total area of the film must be sufficient to give a reasonable number of years of life to the arrester. There are other factors relating to the details of manufacture which give a limited degree of control over this change in equivalent sphere gap.

In all the commercial oxide film arresters used for alternating current the power factor is nearly unity. For special purposes however, the power factor can be made anything desired from 10 per cent. to unity. This is obtained by combining with the conducting oxide other non-conducting materials. This principle has been made use of for condensers, but it has not been found desirable to incorporate it in the arrester.

To summarize—an arrester operating under a new principle has been made which comprises in essence one or more metal electrodes covered with an insulating film, and separated by a conducting powder, which has the peculiar characteristic of becoming a non-conducting powder upon the application of heat. Voltage higher than that which can be withstood by the insulating film punctures it in one or more points of about 0.005 cm. diameter. Dynamic current flowing gives a high current density in the conducting powder adjacent to these punctures which in turn heats it up rapidly, reducing the powder to a non-conductor, and sealing the holes in the film. The powder being a poor heat conductor localizes this action, so that very little more powder is reduced than is actually necessary to seal up these minute punctures.

The critical spark voltage and that part of the equivalent sphere gap controlled thereby is a function of the thickness and kind of material used for the film.

Comparison of the "Oxide Film" with Aluminum Arrester.

The earliest form of non-electrolytic film arrester was known as the dry aluminum arrester. It was a direct attempt to utilize the dry film which forms on the surfaces of pure aluminum immediately after it comes in contact with the oxygen of the air. The hydroxide film is easily formed in electrolyte and on drying becomes a dry film which gives sufficient action to prevent a discharge up to a given critical voltage, depending upon the thickness of the film. The film can also be formed by a spark or arc of a conductor in contact with a plate. Naturally this conductor should be of a non-metallic nature. In the earliest form tried powdered carbon was used mixed with dioxide of maganese which gives a liberal supply of oxygen at the heated point.

One of the objects of the development of this arrester was to decrease the cost of manufacture and it was found with the new principle involved in the oxide film arrester, where the powder furnishes the film rather than the plate, that the aluminum could be replaced by a cheaper metal, such as steel, and, as already described, the initial film known in the early stages of development as the "paint skin" type could be furnished by a layer of varnish. On first sight, knowing the extreme thinness of the hydroxide film on wet aluminum cell it might not seem that the dry cell would give the same general characteristics as the wet cell. But a comparison of the volt-ampere curves shows the same general characteristics. For a.c. voltages of 300 volts average per cell the current in the dry cell is of negligibly small value up to 40 milliamperes. The power-factor is nearly unity and the current flow is due to very slight leakages through the films. In the case of the aluminum electrolytic cells there is an equivalent condition, the d.c. leakage current of the order of one milliampere being due to leaks through the hydroroxide film. In the a.c. aluminum arrester the leakage current on the plate area used is much greater, due to the destructive action of the alternating current on the hydroxide film. Furthermore, the wet cell with its thinner film is a condenser of appreciable capacitance which takes a charging current of about 0.5 ampere at 60 cycles. When the voltage reaches a certain critical value which is between 300 and 400 volts for the wet aluminum cell

and between 300 and 500 for the oxide cell (or higher if the paint film is made thicker) the current is allowed to pass freely through the cells, limited only by the ohmic resistance of the cell independent of the film. Since the oxide film arrester has no dissolution of the film, as occurs in the wet aluminum cell, charging is not only unnecessary but undesirable. This extends the use of the oxide film arrester to localities where there are no attendants.

Although the wet aluminum plate becomes frosted to an appreciable thickness by the passage of current in long use, the actual thickness of the film, as represented by the critical voltage, is not changed. In the oxide film arrester, however, the film less than one 1 mil thick initially thickens up by the addition of successive spots of litharge for each successive discharge. This represents the wear on the arrester and limits its total life. Fig. 1 shows comparative volt-ampere characteristics of the oxide film arrester and the a.c. aluminum arrester. Since both of these arresters have a leakage current which wears the plates of the cells when alternating current is supplied, it is necessary, as previously stated, to place a spark gap in series with the cells. This spark gap is set at a value slightly above the normal potential of the circuit so that nothing but abnormal voltages will cause a discharge.

The Electric Vehicle as a War Measure

By James H. McGraw*

Transportation is one of the vital problems of the day. it deserves the attention of the biggest men in every industry. War has enormously increased congestion in factories, on railroads, in warehouses and terminal yards, and on our city streets. We have more raw materials and more products to handle with fewer men, and with the need for real economy in handling costs.

More minds are being concentrated on transportation than ever before. Government officials, Washington Bureaus and War and Navy Departments, as well as engineers, central station men, electrical engineers in industrial plants, all are considered parts of the problem.

A brief survey of transportation problems in this country brings striking facts to light. Forty-five per cent. of the population live in 11 per cent. of the area of the United States, This restricted area includes N. E. States, New York, Pennsylvania, New Jersey, Maryland, Ohio, Indiana, and parts of Illinois and Michigan.

Of all goods made in the United States, approximately 70 per cent. are made in this area. This concentration of population and manufacturing brings naturally a congestion of traffic, that is little realized until a tremendous added burden is put on it by war needs.

Within the congested area is a still smaller zone which to-day is the red flag zone of the government departments. In this zone, which borders the Atlantic and extends from Baltimore to Maine, there are no raw materials, no bituminous coal, no iron nor other base supplies. To get these raw materials into this region they must go through four gateways, located at Williamsport, Altoona, Shippinsburg and Baltimore. To get coal and basic supplies into the great manufacturing district of New England, where there are so many war plants, there are three gateways: Harlem River, Poughkeepsie and Albany.

No Time for Building

We must win this war with our present main equipment. We haven't time to build more gateways, more railroads, more trunk lines. The so-called red-flag zone this next year will require 90,000,000 tons of bituminous coal, 80,000,000 tons of hard coal. All this product must go through the four gateways.

What does this mean? Broadly, it means that we must concentrate our attention on auxiliary means of transportation to move goods faster and transfer goods more quickly at this point. Every freight car must count. According to lately gathered statistics we need 150,000 cars for replacement alone. The government ordered 100,000, a tremendous order, it is true, but only a part of what is needed to handle materials.

Electricity offers three means of auxiliary aid to the steam railway freight problem at this time. Various classes of hoists and transfer cranes and platforms operated by electricity are in use. Second, there is the industrial electric truck, a low-body, small wheel vehicle which is being used for transfer work in government yards, docks and terminals, munition factories, and so forth; and third, commercial electric trucks for short-haul many-stop deliveries from warehouse to merchant, from merchant to customer.

In both these fields the electric vehicle is now performing work of direct help in war service, and there is a very real opportunity to extend this development tremendously.

Electric industrial trucks are being used more extensively than generally realized in direct government work. Hundreds of trucks are in use at embarkation and debarkation points. Practically all goods going into France are handled at some point by electric trucks. Special trucks with crane, and hoist attachments have been developed. Because of the nature of the work, it is not possible to describe these applications in detail.

Operation Costs

The average cost of operating an electric industrial truck of this kind, including tires, battery upkeep, mechanical repairs, charging, drivers' wages and interest on investment, is between five and six dollars a day. In many instances one truck will do the work of four to six men. In one instance, a truck saved eighteen men a day. These trucks have a speed of five miles an hour loaded, and a capacity of two tons. They are particularly serviceable in operation in munitions factories because the risk of fire is practically negligible. These trucks are being built by hundreds. There are estimated to be 5,000 in use to-day.

Specialized electric trucks for government service have also been built for hospital supply wagons ar l ambulances at base hospitals. An electric kitchen wagon also has been built.

Electric tractors are in operation at the navy yards and supply depots for hauling ammunitions cars.

The war has especially shown the inefficiency of our methods of handling goods out of cars, across platforms and into warehouses. Goods are handled and rehandled without regard to time or labor. This is one of the biggest parts of our transportation problem.

It should be a matter of pride to realize that electricity at the terminals and gateways is helping to move goods cheaper and faster. The industrial electric truck, the electric driven overhead crane, the hoist and telpher systems operated

*Before the N.E.L.A. Convention

by electricity, the night illumination, are all factors in this problem.

Electricity Doing the Job

Electricity is helping to get the job done, and the demand for the industrial electric truck for this work is ahead of the supply, although the trucks are being turned out by several manufacturers. For loading and unloading steamships the electric industrial truck has found a place, ont only because it saves time and labor, but because practically every other type of power vehicle is eliminated from both docks and steamships by insurance companies on account of fire risks.

Industrial electric trucks are helping to get work done in munition factories and arsenals. They have revolutionized the methods of handling goods in many plants. These factories need to-day to increase output by every possible means. They also need to conserve men, both laborers and mechics. The industrial electric truck replaces men, speeds up production, and is so simple a mechanism that it requires little skilled attention.

As a concrete example of what an industrial truck will do, the Packard Motor Car Company have three electric industrial trucks handling scrap metal from the lathes and presses where formerly 48 men were required.

Electric transportation in the factory is simply another example of the widening use of electricity in industries. Central station service and the motor drive have been adopted. The power engineer from the central station has had an opportunity to act as an electric engineer of transportation and to point out to the factory manager just what electricity can do for transportation to his factory.

Local delivery methods are getting the same overhauling as railway, terminal and factory systems. Men are growing scarcer. Wasteful delivery methods can no longer be tolerated. The problem is part of the complete city transportation needs.

Economy in Retail Service

The Commercial Economy Board of the Council of National Defense has just issued a booklet entitled Economy in Retail Service.

The Council of National Defense as a whole also has made this statement: "The Council of National Defense has given its formal approval to all measures designed to facilitate the use of motor trucks in transportation wherever it can be utilized. It is urging all communities as far as possible to adapt the motor truck to their local needs and encourage its use in any way to help existing transportation problems." In neither of these pronouncements is direct reference made to any type of motor truck, but the general idea of replacing horse drawn trucks and perhaps more antiquated delivery systems is being widely promoted. The booklet issued by the Commercial Economy Board is a part of a broad program started in 1917 to show how economies introduced by voluntary co-operation of business would release men, materials, equipment and capital for carrying on the war. The work in retail deliveries was undertaken primarily to conserve labor, to make it unnecessary for merchants who lost delivery men through the draft and other war causes to replace them out of supplies available for ship building, farming, railway transportation, and other war work. A careful survey of the whole country was made among retail and wholesale merchants.

Several of the findings of this survey point particularly to present opportunities for the electric vehicle to meet the problem of local delivery under war conditions. In Massachusetts it was found that 5,230 stores, about half in the state, operated 4,473 vehicles. Of these 3,129 were horse drawn and 1,344 motor trucks. This general proportion of horse drawn and motor propelled trucks holds for the country.

Cutting Costs of Retailing

A second point in this general investigation worth the attention of the electrical industry, is the relative importance of this transportation cost as an element in the merchant's total cost. In the city of Washington, the delivery costs for bakery products averaged 19.8 per cent. of gross sales; for dairy products, 12.1 per cent.; for ice cream, 14.9 per cent.; for coal and wood, 15.2 per cent.; for ice, 45.6 per cent., and for food products, as a whole, 7.4 per cent.

The report contains definite suggestions for changing the methods of delivery. It points out that short haul many stop deliveries generally provide the best service to the customer, and it suggests plans for working out such systems. This, of course, is the ideal field for the electric vehicle. Ninety-five per cent. of the work done by horses on the street can be done by motor trucks. Eighty-five per cent. of the city haulage can be accomplished by the electric vehicle. Figures compiled many times show the inherent economy of the electric in place of the horse drawn wagon. A light truck will move a single horse wagon load of goods one mile for one cent (current at 3 cents per kilowatt hour). Gasoline for that same mile would cost 3 cents and oats for the horse 5 cents. And this is only one element in the cost.

Saving in Hauling Coal

All of the coal used in the Hudson Terminal Building in New York City is hauled from Jersey City by two five-ton electric trucks. By hauling the coal from storage and buying in large volume, the company saves $45 per day. The ferry charges were reduced several dollars a day because the electric for the same capacity was about three feet shorter than a gas truck and so came in a lower class. The cost of handling fuel is one of the elements in our fuel supply that is receiving careful analysis. The electrical truck with suitably adapted bodies is an economical solution of the problem. In one case now being investigated one five-ton truck with different detachable bodies could replace both horse drawn and gas equipment, eliminate surplus equipment and effect a large saving of about 35 per cent. to 40 per cent.

I have briefly summarized the way that electricity is a part of the transportation problem to-day.

The general advantages of the electric vehicle as a part of the big transportation problem may be summarized as follows:

General Advantages

Manufacture—Simplicity of design requires few parts, and almost the total absence of machined steel in power plant. Need of skilled mechanics reduced to a minimum.

Operation—Skilled mechanics unnecessary. Young and old, men and women, are successful operators.

Maintenance—Few parts and absence of reciprocating features assures maximum uninterrupted service with minimum supervision and repair, thus releasing skilled mechanics for more vital war work.

Costs-Operating—Lowest for work accomplished of any form of mobile transportation.

Fuel—Current for battery charging taken off-peak. Conditions abroad are not the same as in this country. We are not yet faced with the drastic shortage in liquid fuel and operators that have faced our allies. The fact remains, however, that the electric has filled a very definite place in the transportation development abroad. For example, there have been six times as many electrics put into service in England alone during the past three years as in all the time before. Electrics have been adopted for handling municipal work, for example, in eighteen towns and cities for garbage collection, road construction, street cleaning and coal deliveries. The Midland Railway has about 110 electric trucks in service and the Great Northern Railway, with eight 3½-ton American electric trucks displaced the entire horse unit in Leeds, 33 horses and 16 vans.

The Electric Vehicle Section of this Association has been working with the French High Commission in New York looking forward to the manufacture of the electric vehicle

in France as a part of the great problem of reconstruction and water power development under way in that country.

Norway is to-day an active market for the electric vehicle, both commercial and pleasure cars.

Opportunity for Central Stations

This discussion has been undertaken to bring before this association not the detail economies of the electric vehicle, which are well known, but the opportunity that the central stations of the country have to aid the government by taking an active part in helping to solve the transportation problem as a whole.

The central stations to-day are furnishing light, heat and power to meet war needs and to conserve men and materials in the commercial and domestic life of the nation.

The transportation problem needs the attention of our biggest electrical men. Transportation to-day is handled with tremendous losses. The movement of freight to-day is a transportation engineering question. As an engineering question the electrical industry will play a large part in the future. The supply of electricity for the big developments to come in cheapening the cost of handling goods in terminals and warehouses, and in cutting the cost of deliveries on our city streets is worth the attention of every central station. The electric vehicle to-day offers an economical solution for an important part of our big transportation problem.

More Power From Shaft by Use of Turbine

Electric motor drive, the simplest solution to additional power supply problem, is oftentimes not available to mill owners, whose plants are driven by line shafts. Often, however, there is sufficient boiler capacity in the plant to do the work, if it is effectively applied, particularly where line shaft drive to a small number of machines is used, in which case the installation of a turbine with speed-reducing gears is an ingenious solution to the problem. A unique line shaft drive, consisting of a low pressure turbine and a daubee reduction gear has been installed in a Western Pennsylvania paper mill. There are two main line shafts to which the machines are belted. To one of the line shafts are belted two cutters, ten beaters and one Jordan. An identical equipment, with the exception of the cutters, is belted to the other shaft. Only seven of the ten beaters, under ordinary running conditions, are in operation at one time, and these, with one Jordan, require about 600 horse power, with an additional 20 horse power for the rag-cutters. Heretofore these two line shafts were each driven by a non-condensing reciprocating engine. However, one of these engines was wrecked, which necessitated obtaining a drive to replace it.

It is interesting to note the considerations entering into the final selection of the new drive. These conditions were somewhat as follows: two 100 horse power non-condensing engines turned the rolls and gears and gave practically all the exhaust steam necessary for feed water heating, so that all the exhaust steam from the 700 horse power non-condensing Corliss engine driving one of the line shafts would have to be discharged to the atmosphere, unless some means were provided for abstracting the energy still available in it. A low pressure turbine was the logical prime mover, without a doubt, but it would have been of little use, on account of its high speed, had there not been a reduction gear to receive the power generated and to deliver it to the line shaft at low speed.

While this particular mill was not enlarged, it is evident that with a given amount of exhaust steam, either from non-condensing engines or condensing engines run non-condensing, a large increase of power is made available by the installation of a low pressure turbine. Further evidence of this possibility for expansion is the fact that in this paper mill when the two line shafts were driven by non-condensing reciprocating engines, a battery of 13 boilers was required, whereas, now only eight boilers are required for the maximum load.

So far this has beeen a discussion of the application of a low pressure turbine, but the means of transmitting its high speed power to a slow speed line shaft is fully as interesting and important. The change in speed is made by means of two reduction gears because the first cost of a single gear and pinion of ratio 36 to 11 would be prohibitive, and the gear would be very large and unwieldy. The first speed reduction, 3,600 r.p.m., to 720 r.p.m., is made with a fixed bearing type of reduction gear, the gear shaft of which is direct connected to the pinion shaft of the second gear which reduces the speed from 720 to 103 r.p.m. This larger reduction gear is of the flexible pinion frame, Westinghouse I-Beam type. It is this I-beam feature which makes the application of the geared drive possible.

It may be asked why a fixed bearing type of reduction gear was used in one case and an I-beam in the other. It was a question of tooth pressure which determined the design. Take for instance a pinion transmitting 600 horse power at 3,600 r.p.m., which was the case of the first reduction gear in the particular installation under liscussion. If the same pinion were to turn at 720 r.p.m. and with the same tooth pressure (i.e., pounds pressure per inch) of tooth face it would be capable of transmitting one-fifth of 600 horse power, or 120 horse power only. It follows, then, that the second gear would have been made five times as large as the first if the same type had been used, and for the transmission of the same amount of power. Such reduction gear would have been large and bulky. It would also have been costly, because cost is a function of size.

Hydro Tenth Annual Report

The Hydro-electric Power Commission of Ontario have issued Vol. 2 of their tenth annual report, which covers the year ended October 31, 1917. This report contains a review of the operation of the various systems controlled by the Commission, financial expenditure on each, quantity of power used, extensions made during the year, and so on. The horsepower load on the various systems in October, 1917, was as follows: Niagara, 121,538; Severn System, 7,854; Eugenia System, 1,715; Wasdell's System, 275; Central Ontario System, 17,426; Muskoka System, 920; St. Lawrence, 739, and Ottawa, 6,500. The expenditures noted on the various systems are: Niagara, $14,386,531; Severn, $867,971; Eugenia, $1,271,736; Wasdell's, $264,731; Muskoka, $190,239; St. Lawrence, $207,234; Ottawa, $433,000; Port Arthur, $109,438; Renfrew, $20,389; Central Ontario, $9,505,249; Ontario Power, $7,996,617. The grand total of expenditure to date is placed at $37,176,901. The report also contains information covering the financial operations of the various municipalities throughout the province—their rates, expenditures, earnings, etc.

In order that the financial difficulties of the city of Prince Albert, Sask., due in a large measure to the expenditure of over a million dollars on the abandoned La Colle Falls hydro-electric scheme, may be overcome, it is proposed that the Saskatchewan government should lend $50,000 a year for a few years at a low rate of interest, and debenture holders be asked to agree to the suspension of sinking fund payments for a similar period, pending the reorganization of finances.

A new Bell Telephone exchange at St. Hyacinthe, P. Q., will soon be put in. A change will be made from magneto to central energy service.

Teaching the Public Why Higher Fares are Essential

The Cape Breton Electric Company, operating an electric railway in Sydney, N.S., recently made application to the Public Service Commissioners of their province for an increase in fares. It is indicative of the changed attitude of the average public service organization toward the people it serves that coincident with this application the company inaugurated a systematic campaign of advertising in the local press in an endeavor to advise the general public of the facts and educate them up to the point where they will be able to make a fair judgment on this question. The average citizen does not stop to consider that the cost of operating an electric railway system has increased in about the same proportion as the price of the average commodity he buys, whereas the rate of fares which the railway company is allowed to charge for its service remains fixed. If 5 cents was a reasonable charge for the average rate four years ago, then, by the law of averages, it should cost 7, 8 or 9 cents to provide the same convenience to-day. As a matter of fact, though this rate would be justified in many cases, no company has asked for any such increase. They have first turned their attention to every possible economy, and now, all sources of revenue having been exploited, they are forced to ask for fare increases.

The form which the advertising of this company, under the control of C. C. Curtis, manager of the company, has taken, is an advertisement about 7 x 10 inches in the form of "One-Minute Talks." For example, in Talk No. 8 there are a few paragraphs explaining how the prosperity of the company and of the public go hand in hand. Talk No. 11 explains about the appointment of a select committee to look into the same question in the British Isles. Talks Nos. 12, 13, 14, 15 and 16 are along the same lines, each of them pointing out one separate viewpoint which is probably new to the railway patrons. As typical of the form these arguments take we are reproducing three of them below:

A campaign of a similar nature is also going forward in other Canadian cities. For example, in Montreal, where the Montreal Tramways Commission conceded the company the right to increase the fares, an effort is being made to prevent the execution of the order. It is surely a perverted idea of justice that would require a tramway company, or any other public utility, to continue operation at a loss, but this is what is demanded of the Montreal Tramways Company by a portion of the city. To correct the false impression being created by the propaganda of these people this company also is having resort to the daily papers. Following are a couple of their recent advertisements:

One Minute Tram Talks — **Talk No. 12**

Capitalization Does Not Affect Fares

For when it comes to a question of what price a Public Utility may charge the public the consideration of the amount of stock and bonds which it has outstanding is all cast to one side.

The Public Service Commissioners ascertain the fair value of the property used for the benefit of the public, what the owners have received on that fair value in the way of income and what will be received in the future. They ascertain the earnings and expenses and the needs of the Company for proper up-keep.

After thorough investigation they will render their decision based on the law which allows a Company to earn at least 6 per cent. on its actual investment.

The Company never has earned this amount and will not with only the small increase in fares now proposed.

C. C. CURTIS, Manager,
Cape Breton Electric Company, Limited.

One Minute Tram Talks — **Talk No. 16**

THE FACTS IN A NUT SHELL

Their earnings are strictly limited by law and Public Utilities cannot make war profits. If they make war losses they can seldom recover them. Therefore they must be kept financially sound and healthy at all times if they are to fulfil their duty to the public.

The increase in fare asked for is estimated to bring in about $30,000.

All this and more is needed to take care of increased wages and increased costs of material and to keep the property generally in good operating condition.

We hope for your support, not only in our own interest, but also in yours.

C. C. CURTIS, Manager,
Cape Breton Electric Company, Limited.

One Minute Tram Talks — **Talk No. 8**

Your Prosperity and Ours Go Hand in Hand

Are we interested in your prosperity?

Most decidedly, YES.

Personally we are interested because prosperity is more conducive to happiness than poverty and hard times.

In a business way we are interested because our Company cannot prosper and grow unless you and the community in which you live have a fair share of prosperity.

We are dependent upon you.

Are you interested in our prosperity?

We believe you are.

You depend upon us for tram service, for transportation to and from work; to and from play.

You could walk but then you wouldn't have the time you now have for work and for play.

If we are not prosperous we cannot furnish good service; we cannot improve our service.

If a merchant's expenses are greater than his income he quickly goes out of business.

We are subject to the same laws of business and common sense.

C. C. Curtis, Manager,
Cape Breton Electric Company, Limited

Tramways and the Rising Tide

Unprecedented increase in cost of material eats up earnings rapidly

The unprecedented increase in the costs of all materials used in construction and operation of street railways, has placed the street railway business in a very serious position. In most cities in the United States the 5-cent fare which has prevailed for many years has been found to be quite insufficient to enable them to do business at a profit, and testimony before various Public Service Commissions has shown that many of the companies are heading straight toward bankruptcy—or will be if relief is not granted in the shape of higher fares. Not half of the Upstate companies in New York States, for instance, are earning even their fixed charges, and matters are growing worse. In some cities fares have already been raised to 6 cents or higher, and practically every important street railway company in the United States is applying for an increase.

Exactly the same condition of affairs confronts the Montreal Tramways. Since the war broke out the costs of all materials, supplies, and labor, have increased enormously. Everything the street car companies buy or do costs more money than ever before. Here are the main facts of the present situation in the Montreal Tramways Service:

1. The ticket has been buying more and better car service for you every year since street railways were invented.

2. The ticket buys for the company less than it ever did of the labor and materials needed to give service.

It takes nearly twice as many tickets to pay for the Montreal Tramways Company's supply bills as it did five years ago.

The reason why the quarter's worth of tickets has shrunk to a value of 15 cents is shown by the following increases in prices, as compared with the prices paid in 1913:

Increase in prices 1918 as compared with prices in 1913:

	Per cent.		Per cent.
Asbestos	250	Motor Equipment	105 1/3
Armatures (W. H. 533)	104	Nails	112
Axles	171	Nuts	109 2/3
Babbitt	147	Switches, electric	110 3/5
Brooms, corn	118	Pins, cotter	112
Brushes, carbon	200	Paint	85
Brass, sheet	200	Plumbers' fittings	100 to 130
Buttons, push	150	Poles trolley	100
Car Bodies	50	Pinions	300
Castings	160	Rope	100
Charcoal	140	Rivets	150
Copper, sheet	128	Rattan	760
Chain	192	Rails	140
Cement	89	Rods, tie	125
Controllers	100	Solder	144
Coal, run-of-mine	110	Screws, iron, wood	129
Slack	143	Screws, brass	200
Switches, track	119½	Steel, mild	137
Fibre	141	Spikes	158
Glass	235	Shellac	176
Gears	180 1/3	Tacks	200
Gear Cases	215 1/5	Trolley bases	104
Heater Equipment	113	Tin	108
Iron, wrought	156		

Increased Rates Granted to Public Utility Companies

The movement for higher fares on the Street Railways, caused by unprecedented increases in the cost of materials and operating is now general throughout the United States. The following are some of the fares recently put in force:

St. Louis, Mo.	6 cents
Kansas City	6 cents
State Railways of Missouri	6 cents
Middlesex & Boston Street Railway	7 cents
Philadelphia	6 cents
Buffalo (authorized by city)	6 cents
Portland, Ore.	6 cents
New Haven	6 cents
Scranton	6 cents
Fall River	6 cents
Bridgeport	6 cents
New Bedford	6 cents
Lowell	6 cents
Hartford	6 cents
Reading	6 cents
Lynn	6 cents
Lawrence	6 cents
Sioux Falls	6 cents
Wilmington	7 cents
Pittsburgh	5-7 cents
Edmonton, Alta. (municipally owned)	7 cents

Forty-one other cities in the United States of over 100,000 population, including New York, Chicago, Baltimore, Minneapolis, Indianapolis and Albany, have applied for a 6-cent fare or higher, and the applications are now being considered.

The Administrative Commission of Montreal have been in conference with the representatives of the Montreal Light, Heat & Power Consolidated, Montreal Water & Power Co., Bell Telephone Co., Public Service Corporation, Montreal Tramways Co., and Dominion Gresham Guarantee Co., on the subject of repairing breaks in the streets. It was agreed to abolish the old fixed rate of $2.50 a cubic yard paid by the companies and that the latter pay the actual cost of repairing the roadways after the excavations have been made. With a view to the general convenience, it has been arranged that the companies make deposits of lump sums; when a company applies to break up a road, an estimate of the cost of repair will be made by the engineering department of the city, and the permit granted if there be sufficient money on deposit to cover the cost. No road is to be broken up without a permit, except in very exceptional circumstances, such as breaking of water or gas mains.

Mr. Justice Lafontaine, in the Superior Court of Quebec, has just ruled that poles and wires of telegraph systems cannot be taxed as "immovable property" for school or municipal revenue. The school commissioners of Lachine, Que., had brought an action against the Great Northwestern Telegraph Company asking that the poles and wires of the company—no mention being made of the number or place—be hypothecated for the recovery of $20.80 alleged to be due as school taxes for the years 1915-16-17. The action was dismissed.

Fares on the Tacoma street railway have been raised to 7 cents.

The Dealer and Contractor

The Manufacturer's Relation to the Contractor

By J. Nelson Shreve*

At times it seems as if the manufacturer's interest often ended at his own shipping door. Nowadays more and more manufacturers are realizing that in the electrical business the retailer posseses even more power to make or mar the product of a manufacturer than in other lines of industry where less engineering is involved. Besides this consideration of the contractor's ability to assist in the engineering end, we have a consideration of the fundamental economic principles of all business. Unless these are understood and industry based upon them, its foundation is of sand. In the past there have been too many sand foundations. It is true we are getting away from this period, which was due largely to the fact that economic principles were regarded as purely academic. The idea of applying them to everyday commercial life was thought Utopian. If they are sound they are practical, a truth which every business man must recognize. As a nation we have in the past been handicapped in our industrial development by too much individualism and too many laws supporting it. We are just entering the age which older nations entered years ago—the age of co-operation.

Efficient co-operation is possible only when the functions of every factor in an industry are clearly understood, and their interrelation honestly recognized by everyone in the industry, and when each is supported by all in the exercise of its proper functions. This is the only sound basis for practical co-operation, and it seems to me no one has presented this so clearly as Mr. Goodwin.

Two Primary Parties.

So far as the electrical industry is concerned there are two primary parties to every transaction—the manufacturer and the ultimate consumer, or, I might say, the public. A sale is not completed until the goods are in service, the final payment made and the public's approval obtained. This approval does not depend solely upon the manufacturer, and it is not determined immediately but only after satisfactory service for years. Between the manufacturer and the public are interjected several important factors: The jobber upon whom many manufacturers depend for the distribution of their product, and the contractor who installs it. The architect and the engineer are also important, though indirect factors, as they are responsible for planning the electrical system and advising the ultimate consumer as to the quality of materials. However, the manufacturer is principally concerned with the jobber and the contractor. The foregoing is general and I shall now consider specifically the points raised.

*President of the Electric Cable Company, before New York State Association of Electrical Contractors and Dealers.

Responsibilty to the Public.

The manufacturer must at all times be conscious of his responsibility to the public, if he would secure and hold its approval. This is the very essence of a successful business policy. It means that his goods must be of a quality that will insure their rendering the public efficient service. In establishing prices he must consider the following:

(1) What are the most economical units in which he can manufacture?

(2) What is a fair additional cost for disbursing them in quantities ordinarily used by the wholesale trade?

(3) What further costs are justified when distributing goods in quantities suitable for the retail trade

These are important considerations in cost accounting, and any manufacturer who ignores them is fooling himself, as well as the public. Recognition by the manufacturer of the service function fulfilled by the electrical jobber and the electrical contractor takes the form of discount. Now everyone, I believe, will agree that there are only two reasons for discount—quantity and service, either or both. A concern that claims maximum discounts from a manufacturer on any basis but that of quantity and service, should not have the claim recognized. The fact that a concern is in the electrical jobbing or the contracting business, or a member of an association, is not sufficient reason for according the recognition asked. To do so would be unjust to those whose services entitle them to the maximum consideration. Manufacturers' selling schedules should be arranged on a basis of differentials which attract and encourage the wholesaler to buy in the most economical units, and the retailer, in turn, to buy as to render maximum service to the manufacturer, the jobber and the consumer.

"Reputation" is Proper Basis.

Reputation, which forms the basis of business building, necessarily plays an important part. What encouragement is there for a manufacturer of high quality materials to give the maximum recognition to a jobber or retailer whose policy is formed solely on price Or to a contractor who sells his services not on the basis of quality but of cheapness? None whatever. I nthe first instance, he is encouraging the inefficient distribution of his product; and in the second instance, he is promoting a quality of work that may make it impossible for his goods to render the service they are capable of rendering. The result is loss of the public's approval. I am presenting no new thought. The facts I have called attention to are well known, but they are not always given proper consideration in establishing a sales policy, and, therefore, reiteration is justified.

Right Also in Practice.

I know the argument that will be advanced in some quarters in opposition to this policy. It will be said that theoretically it is all right, but that competition makes its full practical application impossible. This is not true. The policy is all right in theory and in practice; it is the only sound, economical policy; it can be applied fully and con-

tinuously. I know this is true because I have studied it in older industries and other branches of the electrical industry, and have proved it in my own company. I make this latter assertion because first-hand experience is the most convincing. The public does not demand unfair competition but it wants all that it pays for. Think of the leading concerns in any line of business. Have they attained their position by selling cheap or by selling on the basis of service and quality, with the recognition of the fundamental principles of all business? The question answers itself. It is not worth while wasting time on a prospective customer to whom you cannot sell policy, quality and service, as well as material goods.

Cost Accounting.

The electrical industry is comparatively new, and one of its most serious faults is that it has not developed scientific merchandising to the same extent as older industries. The subject is a large one, and I shall refer only to one phase of it—cost accounting. Unless we have an accurate knowledge of costs, scientific merchandising is impossible. Inaccurate cost accounting is the real cause of most of the unfair competition that exists to-day. Let me illustrate what I mean by presenting a well-known condition in the electrical industry.

There are concerns whose activities include two or more of the factors between the manufacturer and the ultimate consumer. A light and power company may act as a distributer of electrical equipment; a jobber may do contracting work, and a contractor may be a wholesaler and a retailer of electrical devices. Serious objection has been raised to this practice on the ground that it promotes unfair competition. There are many who believe that each factor should be confined to its special function. I do not agree with this point of view. It is not economical to attempt to build artificial barriers in the channel of distribution. Unfair competition does not arise because the concern is operating more than one branch of the industry, but because it is not scientifically merchandising its goods or its brains, and the reason for failure to do so is faulty cost accounting. Costs are averaged with the result that a profitable branch of the business is often made to carry an unprofitable one. You recall the old saying, "Every tub should stand on its own bottom." This contains a sound ecomonic truth. The central station, for example, is not an undesirable factor in jobbing or contracting or retailing, provided it recognizes the factors of cost applying to these branches, and thus preventing its main business from being used to create destructive competition in other lines of the trade in which specialist concerns depend for their entire living. Every branch of a business should be treated as a separate unit in the determining of costs, and made to show a profit; otherwise it is working an injury to the trade as a whole from which it must itself suffer in time. Accurate cost accounting, scientific merchandising—on these depend the fullest development of our industry. As soon as they receive practical recognition, unfair competition will disappear. No concern can justly object to fair competition. If it cannot meet such competition the fault is in itself, and not in any extraneous condition.

Practical Co-operation.

The war has taught us many economic facts, and the necessity for practical co-operation is one, and perhaps the greatest. The government has recognized the necessity for holding in abeyance laws that obstruct legitimate co-operation, and this may be regarded as preliminary to their abolishment or amendment. In no time in our history has there been greater necessity for business men to co-operate in bringing about the scientific merchandising of our goods, our brains and our experience. The winning of the war and the future prosperity of our country depend upon it. This is one of the principal problems of the War Industries Board at the present time.

The Contractor An Essential Part of the Industry.

Therefore, for the development of each individual contractor's business, and for the furtherance of the nation's interest as a whole in the war, it is the duty of every contractor to consider himself an essential part of the great electrical industry, and endeavor to completely fulfill his functions. This involves not only running his own business at a profit—which is a fundamental obligation—but assisting the jobber and the manufacturer to run their business at a profit and to forward the industry as a whole.

Each must co-operate in local, State and national organizations as far as possible. The more the contractor regards the manufacturer and the jobber and central station as necessary parts of his business, the more they will regard him as a necessary part of theirs. Only by organized co-operation can the electrical contracting and merchandising business be built up to the strong position it must occupy in order to do its full part in the development in this country of the great electrical industry.

Electrical Contracting and Retailing

By J. E. Sweeney*

Just a few short years ago the average man got out of bed shivering on a dark, cold morning, lit a smelly kerosene lamp, hustled into his cold clothes, fussed around lighting a wood or coal fire, put on the kettle for coffee, shaving water and face and hand bath. Waited around for half or three-quarters of an hour for the fire to burn up and breakfast to be prepared. If he wished to go to the basement, closet or dark outbuilding he carried that smoking kerosene lamp, a flickering candle or a dim lantern. When ready to go to his work he walked four or five blocks to the horse-car line, with straw or hay on the floor as the heating apparatus, which carried him along in semi-darkness and full discomfort at the rate of possibly six or seven miles an hour.

If his office was above the ground floor he tramped up flight by flight of tiresome stairs. If he wished to communicate with any other person in the city he either walked out to see them or sent a message by the errand boy. All day long that man was dependent on direct manual service. On dark days he was at a loss for any suitable light; on a hot day he wielded a palm-leaf fan, swore at the heat, mopped perspiration from his brow and let it go at that, to the sacrifice of his comfort and efficiency.

In his office he wrote his own letters long-hand; if he wanted to add a column of figures he did it as he had done in school, and probably had it checked by a clerk who used the same method. Arriving home again at night, to communicate with a neighbor meant a visit, to summon a doctor in sickness meant possibly a dangerous delay. Everything that he did was in a way or by a method that we to-day, less than a generation later, would call most uneconomical and inefficient. His whole daily life, both commercial and domestic, was only a slight improvement in materials and methods over that of the savage.

What Electricity Has Done

Now let us see what electricity has wrought. In the electrically equipped home when Mr. Man retires at night he does so without a household worry. If a burglar tries to break into the house a gong sounds both inside and outside of the house, a light flashes in Mr. Burglar's face, sending h'm

*Before Waterloo Rotary Club

living-room. At the proper time in the morning an electrically-operated thermostat arranges things so that the temperature of the room will be just right, and upon arising he has light at the touch of a button. Breakfast also can be prepared at the touch of a button, and when he is ready to go to work he can telephone to the garage for his electric coupe or walk to the corner and board a bright, clean, electrically-heated, ventilated and well-lighted electric street car, and is whisked to his business in safety and comfort. Reaching his office building he climbs no stairs, but an electric elevator hoists him smoothly and quickly to the second or steenth floor, where his office is brightly lighted and cheerful. He has telephones, dictograph, adding machines and other electrically-operated appliances. All day long the electric current surrounds him and works for him; smooths his pathway in business and pleasure, saves him time, effort, energy and worry and increases his efficiency, lengthens his day, shortens his working hours and tirelessly works for his safety, comfort and convenience.

In the Factory

So much for the man in his office. Let us go out to the electrically-operated factories, where we will find electric motors directly connected to every known kind of a machine tool, increasing production and efficiency, and making better articles and more of them than was possible with the older methods, or with the same machine tools driven with other means of power. We also find proper lighting, reducing the possibility of accidents and making better working conditions for employees. In fact, every process that can be electrified is always handled in this manner.

The Home

And then coming back to the home again. In these days we find that you are giving your wife a square deal and full advantage is taken of the many labor-saving devices designed to make the work of the woman easier and more pleasant. Household appliances have been developed to such a point that with their assistance the work of the ordinary home can be accomplished without the aid of hired help and without the work being a burden to your wife. Such machines as electric washers, vacuum cleaners, electric irons, dish washers, toasters and percolators have been developed almost to perfection and should be placed at the disposal of the women in the home by all means. Take, for instance, a washing machine; I venture to say that if Mr. Hubby were to make an agreement with Friend Wife to do the washing turn about that it would work out something like this: there would be just three real regular wash days; she would do the first washing, Hubby would do the second washing, and Friend Wife would do the third, but when it came Hubby's turn again he would see to it that it was done electrically, and, in all probability, would arrange to have a number of other electrical devices put into the home, such as sewing machine motors, percolators, toasters, etc., if they were not there.

Low Cost of Operation

And then, too, let us consider the cost of operation of these remarkable conveniences. A washing machine is operated at an approximate cost of ¾ cent per hour; a sewing machine will run for about five hours for 1 cent; a 40-watt Mazda lamp, which gives approximately 40 c.p., costs 10 cents for 25 burning hours. Another remarkable feature is that in spite of the increasing cost of labor and materials no increase has been made, as yet, in the cost of electric service or Mazda lamps.

It's Up to the Contractor

Now comes the part that I am interested in as an electrical contractor and dealer. You should realize that the installation of electrical wiring and equipment in a modern building, whether it be factory, office or residence, is one of the most important elements in the satisfactory and comfortable use of that building. Provision should be made for all of the electrical conveniences of to-day and foresight used in providing for other devices that we know will be commercialized in the near future.

Telephones in Trains

Reports have recently been made public of a successful test of telephone communication between a train despatcher's office and a moving train, made by the Canadian Government between Moncton and Humphries' Station in New Brunswick. It is stated that communication was easily established between the despatcher and the conductor when the train was moving at a rapid rate; also that the conductor in one part of the train was able to communicate satisfactorily with the engineer, who filled orders to disconnect his engine, proceed forward, stop, return, recouple, back the train onto a switch and perform other operations without any other means of communication. There seems little reason to doubt that it is merely a matter of time when sufficient refinements will have been made in this phase of telephone equipment to permit passengers in transit to place themselves in communication, for business or social purposes, with friends and acquaintances many miles away.

New Hydro Development in Port Arthur District

Sir Adam Beck, Chairman of the Hydro-electric Power Commission of Ontario, has announced the probability of another hydro-electric power development in the neighborhood of Port Arthur on the Nipigon River. On this river there are two sites with a combined possibility of approximately 70,000 h.p. each. At one of these points—the one it is proposed to develop first—there are two main falls within a short distance of each other, with a combined head of 105 feet. One of these falls alone, it is calculated, would give about 30,000 h.p. under a head of something over 50 feet. The Commission's engineers have not yet determined just what plan will be pursued, but present indications are that the first development will be planned to include the whole head of 105 feet for an ultimate capacity of 75,000 h.p. An order-in-council has already been passed for an initial development of 30,000 h.p. This will probably require four units and the expenditure authorized for this development is $4,500,000.

This site is about 65 miles from Port Arthur, which city will be connected with the power site by a 110,000 volt transmission line. The Canadian Northern Railway runs within a few hundred feet of it so the development work will be greatly facilitated.

Re-establishing Cripples

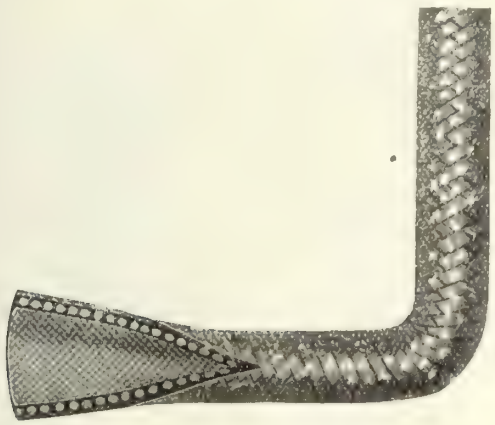
Much has been said regarding the plans of the Dominion Government to help war cripples secure remunerative employment in spite of even the most serious wounds or other injuries, but comparatively few people have seen actual evidence of the miracles being wrought for the men by specialized vocational training and physical reconstruction. At the Canadian National Exhibition some fifty men who have been restored to full usefulness, will demonstrate how the soldier beneficiaries of the government's rehabilitation programme have been made economically self-supporting. Included will be a number of blind men, who have been re-educated and are back on the civic payroll. These men will demonstrate at least 15 industrial processes, including typesetting, oxy-acetylene welding, jewelry manufacture, lens grinding, assaying, etc.

A newspaper report states that the Marconi Company will shortly erect the world's largest wireless station near Buenos Aires. Three towers, each the size of the Eiffel tower, are to be erected.

What is New in Electrical Equipment

Kraft Cord "Braiduct"

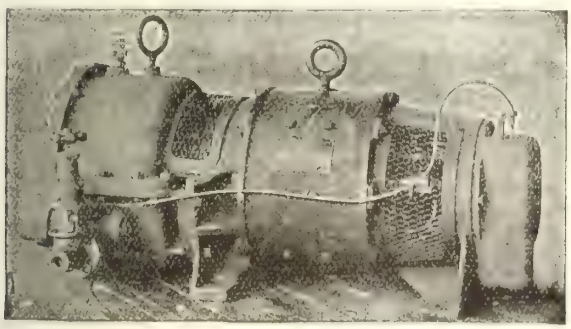
The Flexible Conduit Company, Limited, of Guelph, Ont., have placed on the market an addition to their lines of flexible conduits, under the name of Kraft Cord "Braiduct." A new feature is that the Kraft Cord is fireproofed and made to special specifications prepared by the company. The insulating compounds used are made in the company's own plant



and the product is uniform in flexibility. Every foot is fished by an automatic fishing device invented by themselves. The company further state that Kraft Cord "Braiduct" is regularly inspected and labelled by the Underwriters' Laboratory, under the direction of the National Board of Fire Underwriters, and every coil carries the Underwriters' label.

Westinghouse Brings Out Small Turbo-Generator Unit.

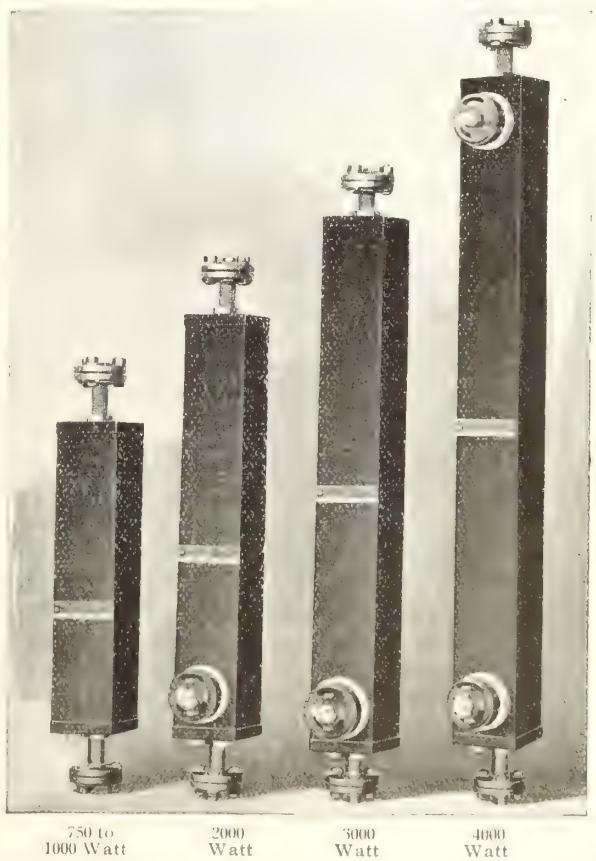
The Westinghouse Electric & Manufacturing Company has recently produced a small turbo-generator unit for direct-current service. This unit is designed for 10 kilowatts output, although a temporary load of approximately 12.5 kw. may be obtained. The most important feature of this unit is that it is but one revolving element in which the generator shaft is extended so that it also carries the turbine rotor. This not only makes a very compact machine, but



eliminates all coupling and misalignment troubles, and dispenses with turbine bearings and packings. The turbine rotor is made of a high grade open hearth steel forging accurately finished, in the periphery of which are placed blades of electric furnace steel which are held in place by pins tightly driven in through blade and rotor. The blades are of the impulse type and although there is only one row of blades yet by means of a reversing chamber the same steam is passed through the blades a second time, thus allowing complete expansion of the steam. Since the unit is designed to occupy the least possible space, the manufacturer has equipped the generator with ball bearings (no bearings being required on the turbine instead of the usual type of surface bearing; thus saving in bearing friction with a consequent decrease in length and weight of the unit is effected. Moreover these self-aligning ball bearings on small units are suited for a variety of services, particularly for marine work which often times compels the unit to operate at an angle due to the position of the ship.

New Hughes Water Heaters

The Hughes Electric Heating Company have placed a new type of water heater on the market in various capacities, as shown in the accompanying illustration. These heaters are made in sizes 500, 750, 1,000, 1,500, 2,000, 3,000 and 4,000 watts. Larger sizes are made to order. In capacities less



than 1,000 watts only single heat switches are supplied; from 1,000 to 3,000 single, two or three heat; 4,000 and over, six heat. These heaters are manufactured with a very special insulation and are claimed to be very efficient. The fact that some 700 of them have been sold within the last six months appears to bear out this claim. They are manufactured for either 110 or 220 volts.

Two linemen were severely shocked in St. Thomas recently while cutting and trimming trees. A large limb fell on a high tension wire, short circuiting the street lighting system. Considerable damage was caused in the power-house and to smaller wires throughout the city.

Wiremold Catalogues

Canadian Company, Limited, have issued an attractive Wiremold catalogue with installation suggestions. This company are sole Canadian distributors for Wiremold, and in this booklet point out the economical possibilities of its use. It is stated that 1,500 feet of Wiremold, as compared with an equal quantity of ½ inch conduit, saves a ton of steel—no small consideration at this time, when so much of the latter commodity is required for war purposes. The catalogue is divided into three sections: section I. describes the various fittings and their method of installation; section II. contains some notes on bending Wiremold, passing around beams, tapping, etc.; section III. illustrates a number of typical Wiremold installations in homes, stores, offices and factories. The company have also ready for distribution a couple of attractive booklets, "Wiremold in Your Business" and "Wiremold in Your Home." In these booklets actual installations are portrayed showing the many uses to which Wiremold may be put and the resulting conveniences.

The fare on the B. C. E. R. in Vancouver is now six tickets for 35 cents, or six cents straight. No money is to be deposited in fare box—single tickets must be purchased from the conductor and placed in the box by the passenger. To relieve the shortage of coppers the company have issued one-cent coupons which are accepted as cash by conductors or redeemed at the head office.

Personal

Mr. Arthur Parent, superintendent of lighting for the city of Montreal, has been appointed a deputy director of the civic Public Works Department, with charge of the lighting, parks and ferries, incineration, and municipal buildings.

Dr. Alfred Stanfield, for many years professor of metallurgy at McGill University, has been in British Columbia for some time investigating the possibility of the electrical smelting of iron ores in that province. The investigation is being undertaken on behalf of the Department of Mines.

Mr. C. H. Tillett has been appointed electrical engineer of the Grand Trunk Railway, in succession to Mr. J. A. Burnett, who has been appointed technical assistant with the British War Mission, Washington. Mr. J. J. Ginty succeeds Mr. Tillett as supervisor of signals, eastern lines.

Major William Thomas Wilson, R. E., A.M.E.I.C., has been awarded the Military Cross. Major Wilson was formerly a member of the engineering staff of the Montreal Light, Heat & Power Company, and later manager of the Dorchester Electric Company, Quebec, now controlled by the Shawinigan Water & Power Company. He joined the overseas forces in 1915, and was afterwards transferred in France to the Imperial Forces, being promoted to captain, and in 1916 to major. He has been twice mentioned in despatches.

Mr. M. C. Gilman, for several years with the Toronto Electric Light Company, latterly as sales manager, has resigned to become manager of Willis L. Adams' Montreal office, at 501 Power Building, who handle the sale of Packard transformers and meters; Thomson spot, butt and seam welders; Majestic electric heaters; a line of motors and arc welders; and "oil gas" furnaces in Canada east of the C.P.R. line Kingston to Renfrew. In addition to his regular work with the Toronto Electric Light Company, Mr. Gilman has been particularly active in association work. Latterly he has been secretary of the Canadian Electrical Association, in addition to which his name has always been in evidence on committees. Some of the most valuable committee reports presented before the Association in recent years have been largely due to Mr. Gilman.

Vancouver Convention

The second annual meeting of the British Columbia Association of Electrical Contractors and Dealers will be held at Victoria on Friday and Saturday, August 16-17, and will include banquets and a picnic, in addition to the regular business. It is felt by the officers of the Association that this will be the greatest meeting of electrical men ever held in Western Canada, and a cordial invitation is extended to the electrical trade everywhere to be on hand, if at all possible. It is announced that Albert Elliot, of San Francisco, will be present to address the gathering. Further information and particulars regarding the convention may be secured from the secretary, Captain W. J. Conway, 406 Yorkshire Building, Vancouver.

The British Columbia Electric Railway Company, Vancouver, B.C., have outlined a tentative proposal to the city to operate their system on a "carry for cost" basis, the company requiring only a reasonable interest on the capital value of the plant and facilities used, to be established by valuation.

At a meeting of the ratepayers of Mount Dennis, Ont., recently, it was decided to enter negotiations with the Hydro-electric Power Commission for a supply of power for the town. It was pointed out, as an argument in favor, that the town of Woodbridge, where the installation was only four years old, was now entirely out of debt.

Trade Publications

C.G.E. Publications—Type IL series transformers for street lighting service. This is a transformer designed to operate single 15-20 amp Mazda series lamps, the current being stepped up from standard 6.6 or 7.5 amp. The dimensions are such that the transformer may be comfortably housed in the post of the lamp-pole, or, if necessary, may be placed underground near the lamp-pole. Other publications include a folder describing CR 3204 drum type controllers for slip-ring induction motors, and folder CR 2820-797 time element overload relay.

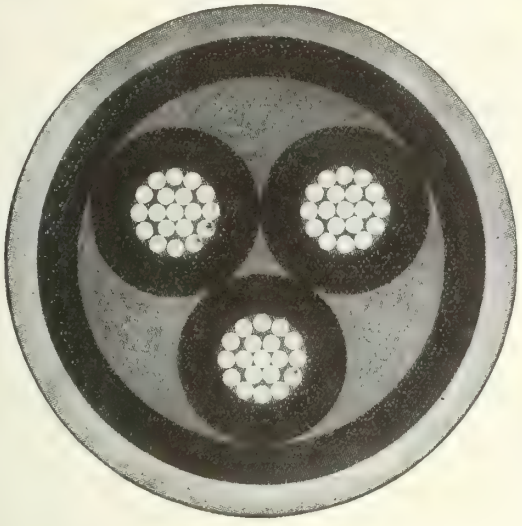
Electrical Catalogue No. 45E, by Nerlich & Company, Toronto, contains descriptions and illustrations of fixtures, portables, glassware, brass parts, supplies, flashlights and appliances carried by the company.

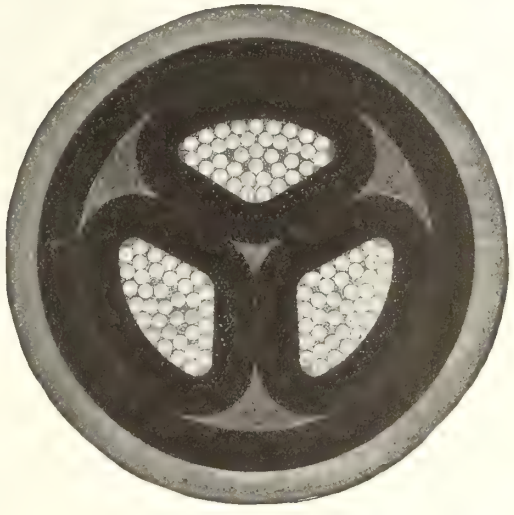


One of a large number of attractive table lamps shown in Nerlich's handsome new catalogue noted above.

PHILLIPS' CABLES

as supplied to the Toronto Hydro Electric System





These illustrations show cross sections in the original size of cables recently supplied to the T. H. E. System and reordered by them for further extensions. The specifications are as follows.—Conductors composed of 37 strands each, .082 in. diameter. Thickness of dielectric on each conductor, .210 in. Thickness in belt, .210 in. Thickness of lead sheath, .160 in. Overall diameter, 2.61 in., 250,000 C.M. Three Conductor, Paper Insulated, and plain Lead Covered Cable for 13,200 volts. We can supply you with wires and cables of any size for Power, Lighting, Telephone, Telegraph, etc.

Write us for detailed information.

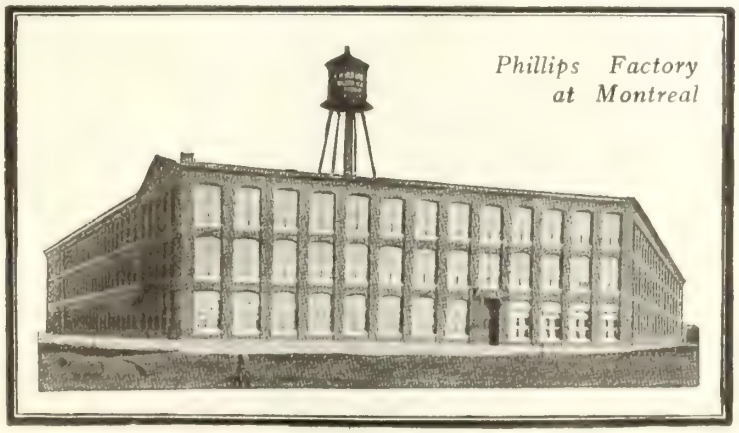
NOTE.—Specification of cable in left-hand cut: 3/0 B. and S. Three conductor. Each conductor 19 strands, each .094 in. diam. Thickness of dielectric on each conductor, .21 in. Thickness of dielectric on belt, .21 in. Thickness of lead sheath, .15 in. Overall diameter, 2.60.

Specification of cable in right-hand cut: As stated in copy.

Eugene F. Phillips Electrical Works, Ltd.

Head Office and Factory: MONTREAL

Branches: Toronto Winnipeg Regina Calgary Vancouver



Phillips Factory at Montreal

Current News and Notes

Brantford, Ont.

The Brantford Municipal Railway Commissioners have decided to eliminate the eight-for-a-quarter limited tickets, retaining the six for a quarter tickets which may be used at any time. There will be no further changes at present, the cash fare remaining at 5 cents. On the Grand Valley Railway, however, fares have been raised from 30 cents to 35 cents.

Hull, Que.

An increase in the passenger and freight rates on the Hull Electric Railway Company's lines to Aylmer and intermediate points has been allowed by the Board of Railway Commissioners. Passenger rates are to be increased approximately 15 per cent. and freight rates will vary in increase according to the commodity transported.

Kingston, Ont.

For the first time in its history the Camden Independent Telephone Company is unable to pay a dividend. It is thought that the recent increases in the price of material and labor will necessitate a higher rental.

Montreal, Que.

A. A. Giddings & Company, Limited, have been granted letters patent to carry on a general electrical business. Head office is to be in Montreal, and capital stock $50,000. The present business of A. A. Giddings & Company is to be taken over.

La Compagnie d'Ouvrages Artistiques en Cuivre, Ltd., has been formed with a capital stock of $49,000, to manufacture electroliers, light fixtures and electric heating apparatus, electric clocks, and other electrical supplies. The principal place of business is Montreal.

The Globe Electric Company of Canada, Limited, Montreal, have been granted a Dominion charter.

Newcastle, N.B.

The city council of Newcastle, N.B., have under consideration the expenditure of $125,000 on an electric plant. It is proposed to generate power on the Sevogle River, 26 miles from the town, and a report on the feasibility of such a plan is now being prepared.

Rainy River, Ont.

The Rainy River Electric Light & Power Company have completed arrangements to sell their property to the municipality. The latter will take possession in the course of the next few weeks. Mr. W. H. Green, manager of the Rainy River company is, fortunately, retaining his position with the municipality.

Regina, Sask.

The Great Western Electric Company, Limited, Regina, have made application to change the name of their company to the Midland Electric Company, Limited.

St. Catharines, Ont.

The financial report of the St. Catharines light and power department for the month of June showed earnings of $11,743; expenses $9,035; gross surplus $2,708, and net surplus $1,708. There are 3,270 consumers and a steady increase in business.

Scarboro Township, Ont.

The power lines of the Ontario Hydro-electric Commission, being constructed through Scarboro township, are practically completed and current will soon be available in Agincourt.

Sorel, Que.

The Sorel Electric Light & Power Company, Sorel, Que., are changing their system from 30 to 60 cyles and their transmission voltage from 11,000 to 20,000 volts. The change-over includes installing automatic induction regulators on all feeders, changing the town distribution from 2,300 volts, 3 wire, to 4000 volts, 4 wire, and the building of new sub-stations and installation of synchronous condensers.

St. Hyacinthe, Que.

Millette & Company, electricians, St. Hyachinthe, Que., have registered.

Teeswater, Ont.

The ratepayers of Teeswater, Ont., voted July 15, on the question of purchasing the privately owned electric plant and operating it as a municipal system.

Toronto, Ont.

The Hydro-electric Power Commission have granted the city of Toronto a rebate of $1 for each street light discontinued under the conservation of electricity scheme, and it is estimated this will mean a saving of $44,000 yearly for the taxpayers.

The Leaside Munitions Company, Toronto, have applied to the Hydro commissioners for a supply of 2,500 horsepower.

The Toronto Hydro-electric commissioners have under consideration a supply of power for the new Union Station.

Walkerville, Ont.

The net surplus of the Walkerville municipal light and power department for the last financial year amounted to $10,386, an increase of approximately 100 per cent. over the previous year. Earnings during the past year totalled $152,162 as compared with $112,465 the previous year.

White Rock, B.C.

The Corporation of the District of Surrey, Cloverdale, B.C., have commenced the installation of 20 street lights at White Rock, having signed an agreement with the British Columbia Electric Company to furnish current for seven years.

Produce and Save

The management of the Canadian National Exhibition have distributed this year a poster entitled, "Produce and Save." Production is impersonated by a young maiden, "Agriculture," who is shown with a graceful, powerful stride scattering the grain broadcast over the prepared land. In the background are shown the exhibition buildings, as typical of the time and place where we are taught how best both to produce and to save. The paster draws attention to the date of the exhibition, August 26 to September 7, inclusive, and, briefly, to the most prominent features, which include 1,200 performers, a spectacle of courage and faith in "Britannia Militant," the usual varied and complete exhibits of farm products—live stock, and an unusual display of tractors and other man-power-saving devices. In view of the importance of agriculture in winning the war, our national exhibition should attract more than ordinary attention this year.

The Hydraulic Power Company, Niagara Falls, N.Y., are working on an addition to their present plant, which will have an ultimate capacity of 330,000 horsepower. This will be made up of 10 units of 33,000 h.p. capacity each. The immediately present installation calls for two such units and these, it is expected, will be in operation this autumn.



Give It The Bending Test

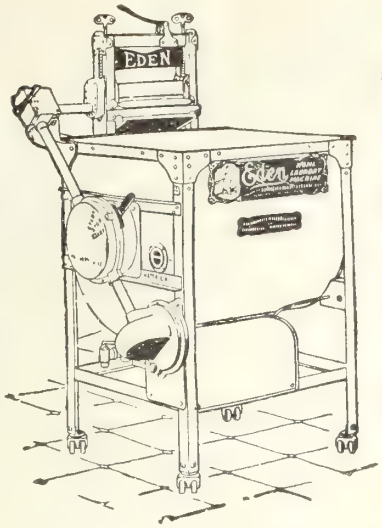
Bend It, Twist It—Try to Tear or Break It

Spaulding HARD FIBRE

Your two hands will tell you the reason for the superiority of Spaulding Hard Fibre as an insulator and universal mechanical material.

Made in sheets, tubes, rods, washers and special shapes; red, black and grey colors.. Send for samples.

J. SPAULDING & SONS CO.
TONAWANDA, N.Y.
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The EDEN Electric Washer

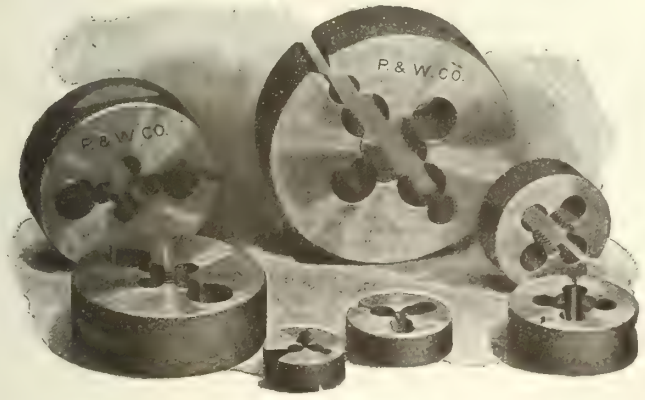
Good Profits—Easy Sales

are assured for the dealer who handles the Eden Washing Machine. A first grade machine, that once sold, stays sold and brings new customers.

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Steam Engines for Immediate Sale

suitable for general mill work, power transmission by belt, rope drive or spur gearing, for driving wood working, grinding, crushing, or hoisting machinery, or air compressors, in factories, saw mills, pulp and paper mills, ship yards, munition works, mines, grain elevators, etc.

2 300 h.p. vertical cross compound, 4 valve engines with shaft governors, cylinders, 18 and 24 x 24 in., 150 r.p.m., with surface condensing equipment for each engine.

1 300 h.p. vertical cross compound, 4 valve engine with shaft governor, cylinders, 20 and 38 x 24 in., 150 r.p.m., without condenser.

2 600 h.p. horizontal cross compound, Corliss Engines, 18 and 34 x 42 in. cylinders, 100 r.p.m., with separate surface condensing equipment for each engine.

1 1200 h.p. cross compound Corliss engine, cylinders, 26 and 52 x 48 in., 85 r.p.m., with surface condensing equipment.

2 1200 cross compound Wheelock gridiron valve engines, cylinders 27 and 52 x 46 in., 90 r.p.m. One surface condensing equipment for the 2 engines.

These engines now have electrical generators mounted upon them which the present owner wishes to keep. Generators to be removed from engine shafts and engines sold without them.

These engines could be fitted with new drive wheels for either belt or rope driving, or with spur gearing, making them available for any kind of factory duty.

The 1200 h.p. Corliss engine is an especially heavy machine. All of them have been operated at 135 pounds steam pressure and about 25 inches vacuum.

There is also one 250 h.p. Wheelock type, cross compound engine, cylinders 16 & 27 x 40 in. with belt type flywheel and surface condenser.

These engines are to be sold as they stand. Overhead hand traveling cranes in place available for dismantling.

Purchaser to make his own inspection, to have access to all available records, and to remove engines and condensing equipment at his own expense. The air and circulating pumps to accompany the condensers.

If prompt possession of any or all of these engines is desired, time will be saved by the Purchaser sending his representative here without delay.

Correspondence is desired only with parties who have immediate use for any or all of these engines.

WINNIPEG ELECTRIC RAILWAY CO.,
15-16 Winnipeg, Man

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Wanted—Experienced man, returned soldier preferred, to act as Meter Reader and Inspector. Apply, stating experience, to Smiths Falls Hydro-Electric System. 12-t.f.

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Competent Electrical Wiremen

Steady Employment, Good Wages, Ideal Conditions.

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2 [illegible] h.p. used motors 2,000 r.p.m.
3 [illegible] h.p. used motors 1,400 r.p.m.
D.C., 220 volts; shunt or compound wound.

Reliance Engraving Company,
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BOILERS

For Immediate Sale

Suitable for ship yards, munition works, mines, mills, elevators, electric power stations, etc.

5450 H.P. of B & W Stationary Boilers

with forged steel headers, and superheaters, in the following sizes:

2—450 h.p. Boilers, 16 wide 12 high, 2—48 in. drums each, installed 1902.
3 590 h.p. Boilers, 21 wide 14 high, 3—42 in. drums each, installed 1905.
3 390 h.p. Boilers, 16 wide 12 high, 2—42 in. drums each, installed 1910.
1 580 h.p. Boiler, 24 wide 12 high, 3—42 in. drums, installed 1910.
2—515 h.p. Boilers, 21 wide 12 high, 3—42 in. drums each, installed 1910.

Eight of these 11 Boilers are now allowed 150 pounds steam and 3 are allowed 135 pounds. All are in operative condition.

If it is desired to add to the capacity of any modern boiler plant carrying 200 pounds pressure for supplying steam turbines, these boilers can be easily adapted to 200 pounds pressure by being fitted with new drums.

To be sold as they now stand, including grates and the usual boiler connections and fittings attached to them. Purchaser to make his own inspection, to have access to all available records in Owner's possession, and to remove Boilers at his own expense.

If prompt possession of any or all of these Boilers is desired, time will be saved by Purchaser sending his representative here without delay.

Correspondence desired only with parties who have immediate use for any or all of the Boilers.

Upright closed type feed water heaters, and boiler feed pumps belonging to this plant are also for sale.

WINNIPEG ELECTRIC RAILWAY CO.,
15-16 Winnipeg, Man.

FOR SALE

Belliss and Morcom Engine

Vertical, 225 H.P., 150 lbs., 425 R.P.M., direct connected to 150 K.W., D.C. generator, 3 wire, 110/220 volts. Set practically as good as new and can be sold low enough to warrant scrapping the generator if desired.

PUMP

Motor driven, 4,800 U. S. gals. per min., 180 lbs., direct connected to 675 H.P. motor, 2200 volts, 3 phase, 60 cycles, 1180 R.P.M. In first class condition, with accessories, including spare impeller, foot valve, butterfly valve, switchboard lightning arresters, etc.

Apply Box 765, Electrical News, 119 Board of Trade Building, Montreal. 15-15

Making Consumer 100 Per Cent. Efficie

A government patriotic food show, o cupying one entire building, will be or of the features at the coming Canadia National Exhibition. The show will l in charge of the Food Controller's D partment and experts from Macdonal Institutes, at Guelph and Quebec, fro Toronto University and other domest science schools, will demonstrate th many discoveries in kitchen economic made since Miss Canada took up the tas of food conservation. It will be th most comprehensive attempt yet mad by the government to teach in a simpl practical way the housewife methods c keeping down expenses without lesser ing in the least the nutritive and palat able qualities of her meals. To mak Canada 100 per cent. efficient in foo consumption is the avowed object of th display.

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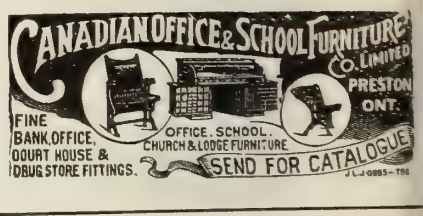
MOTORS

FOR IMMEDIATE DELIVERY

No.	H.P.	Phase	Cycle	Volts	Speed	Maker
1	100	3	25	550	480	Westg.
1	40	3	25	550	750	C. G. E.
1	35	3	25	550	720	Westg.
1	30	3	25	550	1500	T. & H.
1	25	3	60	2000	900	C. G. E.
1	20	3	25	550	1440	J. & M.
1	15	3	25	550	1500	C. G. E.
2	10	3	25	550	720	Westg.
1	5	3	25	550	1500	C. G. E.
1	5	3	25	550	1440	Excelsior
1	5	3	25	550	1400	Westg.
1	4	3	25	550	1400	Excelsior
1	3	3	25	550	1500	C. G. E.
3	3	3	25	550	1400	Excelsior
1	¼	1	60	110	3400	Diehl.

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2--450 K.V.A. 25 Cy. 550 or 2200 Volt, 3 Ph. 125 R.P.M. West'g Generators, direct connected to McIntosh & Seymour Engines, complete units.

1--300 K.V.A. 60 Cy. 2200 Volt, 3 Ph. C.G.E. Generator.
1--150 " " " " " " "
1-- 75 " " " " " West'g. "
1-- 50 " " " " " C.G.E. "

TRANSFORMERS. 3--100 K.V.A. 25 Cy. 13200 to 6600/2200 VOLT C.G.E. S.P.
Also Large List in 60 Cycle

MOTORS. 25 and 60 Cy. MOTORS IN 550 and 2200 VOLT, 3 Ph.

WANTED—100 to 200 K.V.A., 25 Cy., 3 Ph. Generators, also large units of 1000 K.V.A. and upwards, any type.

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Selections from Our Stock of Motors
3 Phase, 60 and 25 Cycles

3 PHASE, 60 CYCLE MOTORS

Qu.	H.P.	Make	Volts	Type	Speed
1	¼	R&M NEW.	110		1700
1	½	G.E. NEW..	110	KT	1800
1	½	G.E.	110	I	1800
5	1	G.E. NEW .	220	KT	1800
1	1	Fbks. M. ...	440	B	1200
4	3	Wstgh. New.	220	CS	1130
2	3	R&M NEW.	220		1150
2	3	G.E.	220	KT	1800
1	3	G.E.	220	KT	900
3	3	G.E.	220	KT	1200
1	3	Cr. Wh.	220		1720
3	5	Cr. Wh. ...	220	Q	1720
1	5	Cr. Wh. ...	550	Q	1720
1	5	Wstgh.	220	CCL	1700
8	5	Wstgh. New.	220	CCL	1700
53	7	G.E. (motors only)	550		1200
1	7½	15 Cr. Wh.	220/440		865/1735
2	7½	G.E. NEW .	220	KT	1800
1	7½	G.E. NEW .	220	KT	1200
6	7½	G.E. (motors only)	550	KT	1800
2	7½	G.E. NEW .	220	KT	900
2	10	G.E. NEW .	220	KT	1800
1	10	Wstgh.	220	CCL	1700
1	10	Wstgh.	220	CS	1150
1	10	Cr. Wh. with resistance type starter	550	Q	1800
1	10	G.E.	220	L	1200
1	10	Robbins & M	220	K	1750
1	15	Wagner New motor only ..	440		1165
2	15	Wstgh. New.	440	CS	1155
1	15	G. E.	220	I	900
1	15	Wstgh.	220		1155
2	15	G.E. NEW .	220	KT	900
2	15	Fbks. M.	220/440	KBV	1200
2	20	Wstgh.	220	CS	1160
50	20	Fbks. M.	220/440	KBV	1200
13	25	Wagner...	220-440	KBV	1200
2	30	Wagner New	220		850
1	35	G.E.	220	KT	600
1	35	Triumph.	220/440		900
1	40	Wagner NEW .	220/440	BP	850
1	40	Fbks. M.	220		900
1	35	G.E. NEW .	220	M	900
1	35	Westgh.	220		1170
1	40	Westgh. New	220	CS	870
1	50	Westgh.	220		860
1	50	Triumph . . .	220		720
1	50	Allis-Chal. .	220		1750
1	75	Allis-Chal. .	550		690
1	75	Westgh. New	440	CS	720
1	100	Allis-Ch. . .	550		690
1	100	G.E.	550	K	600
1	100	G.E. NEW .	550	M	600
1	100	Westgh.	440		1200
1	125	G.E.	220	L	690
1	150	G.E. NEW .	220	M	580

3 PHASE, 25 CYCLE MOTORS

Qu.	H.P.	Make	Volts	Type	Speed
2	5	Wstgh.	220	CCL	705
1	10	Wstgh. New.	220	CS	750
1	12½	G.E.elev.type-high torque	220	KTE	750
15	15	Allis-Ch. . .	220		750
7	20	Allis-Ch. ..	220		750
1	40	Wstgh. . .	220	MW	695
1	50	Allis-Ch. intermittent duty, sl. rg. drum controller	440		500
1	55	Wstgh.sl.rg. 30 cycles, complete. .	440		860
1	60-45-30	G.E.	440		500/375/250

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4—300 H.P., 200 lb. pressure water tube "Atlas" Canada Foundry boilers.
4—201 H.P., 160 lb. Babcock & Wilcox water tube boilers.
1—Feed water treating tank.
5—Boiler feed pumps.
1—Wainwright feed water heater.
3 Jet Condensers
1—1,000 H.P., 98 R.P.M., 24 inch x 36 inch x 46 inch Inglis Vertical Cross Compound Condensing Engine.
1 Canada Foundry Triplex Pump, motor driven, 300 gallons per minute; cylinders 8 inch x 12 inch.
1—Traveling Crane, 35 foot span.
2—150 K.W., 250 volt, D.C. Generators, direct connected to Peerless self-oiling automatic engines, 125 lbs. working pressure, 230 R.P.M.
2—400 K.W., 250 volt, 300 R.P.M., belted Compound D.C. Generators, C.G.E.
4—200 K.W., 360 R.P.M., single phase, 60 cycle, 2200 volt, C.G.E. A.C. Generators.
Quantity of 52 inch belting, idlers, and various boiler and engine room accessories.
Piping, Valves, Fittings, etc.
180—Type H, C.G.E. 2200/220/110, 60 cycle line transformers, sizes 1 K.W. to 15 K.W.
2000—Poles in various lengths, 60 ft. to 20 ft. Crossarms, brackets, insulators, etc.
Quantity of No. 6 weatherproof wire.
1500—Watthour meters, 110/220 volt, 60 cycle, and 250 volt D.C Ferranti and C.G.E. Various sizes from 5 amp. to 150 amp
10—D.C. motors, 500 volt, 1 H.P. to 20 H.P.

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USED EQUIPMENT

Motors

3 PHASE—25 CYCLE

No.	H.P.	Make	Type	Volt	R.P.M.
1	1200	G. E.	I.P.	2080	250
2	750	West.		220	292
1	275	G. E.	Syn.	6600	275

3 PHASE—60 CYCLE

No.	H.P.	Make	Type	Volt	R.P.M.
1	1000	West.	H.F.	2200	360
1	300	G. E.	ATL	2300	225
1	300	A. C.	ANY	2200	505
3	250	Burke	Ind.	6600 2200	514
1	500	West.	C.S.	2200	1150

Transformers

25 CYCLE

3—375 K.V.A., 1 ph., 13200/6600-440/220 G. E.
3—100 K.V.A., 1 ph., 13200/6600-2200 G. E.

60 CYCLE

3—670 K.V.A., 1 ph., 2300/60-70-90-105 G. E.
12—250 K.V.A., 1 ph., 6600/2300 G. E.
3—150 K.V.A., 1 ph., 2300 76 Wagner.

Belted-Generators

ALTERNATING CURRENT

1—275 K.V.A., 25 cycle, 6600 volt, 275 R.P.M. G.E. complete.
1—400 K.V.A., 60 cycle, 480 volt, 600 R.P.M. G.E. complete.
1—250 K.V.A., 60 cycle, 2300 volt, 600 R.P.M. Burke
1—100 K.V.A., 60 cycle, 2200 volt, 900 R.P.M. Ft. Wagner.
1— 75 K.V.A., 60 cycle, 2300 volt, 276 R.P.M. W. E. Co.
1— 50 K.V.A., 60 cycle, 2200 volt, 1200 R.P.M. Westinghouse.

DIRECT CURRENT

1—300 Amp., 6 volt, D.C. plating generator, complete.
1—300 KW., 600 volt, 160 R.P.M. Westinghouse Rly. Generator complete.
1—500 KW., 550 volt, Type M, 320 R.P.M. Westinghouse Generator.
1—150 KW., 550 volt, Type M, 575 R.P.M. Westinghouse Generator.
1—450 KW., 250 volt, Type M, 320 R.P.M. Westinghouse Generator.

Engine Generator Sets

ALTERNATING CURRENT

1—450 KW., G.E., 2300 volt, 3 phase, 60 cycle, 100 R.P.M., direct connected to Allis cross compound Engine, complete with Wheeler condenser and feed water heaters.

1—600 KW., West. Alternator, 2300 volt, 3 phase, 60 cycle, direct connected to West. cross compound Engine.

1—700 KW. Ditto, direct connected to gas Engine.

1—Alternator, C.G.E., 60 cycle, type T.T.B., class 48-600-1501, Form E., volt 2,200, amp. 158, speed 150, direct connected to a Rice & Sargent Providence Engineering Works 18 in. x 36 in. x 32 in., horizontal cross compound condensing engine, complete with condensers; Wainwright horizontal copper tube water-heater; switchboard, piping and valves. Ask for further information.

DIRECT CURRENT

1—550 KW., 600 volt, A.C.B. Generator, direct connected to a Goldie & McCulloch cross compound Corliss Engine, complete.

MOTOR GENERATOR SETS

1—300 KW., G.E., 125/250 volt, 720 R.P.M., D.C. Generator, direct connected to one 450 H.P., 3 phase, 4000/2300 volt, 60 cycle, Ind. motor, complete with switchboard equipment.

1—150 G.E., 125/250 volt, 900 R.P.M., D.C. Generator, direct connected to suitable syn. motor, 2300 volt, 3 phase, 60 cycle, complete with switchboard equipment.

2—30 KW., 125 volt, West., 1140 R.P.M., D.C. Generator, direct connected to one 3 phase, 60 cycle, 220/440 Ind. motor.

ROTARY CONVERTERS

2—200 KW., 3 phase, 25 cycle, 600 volt, D.C., primary, 13200/1180 volt.

1—500 KW., 550 volt, D.C., West., 3 phase, 25 cycle, with 3 suitable S.P. Transformers, 13200 volt P. and 390 volt S.

4—500 KW., 600 volt, D.C., Rotary Converters, 3 phase, 25 cycle, with suitable transformers; 6600/5940 volt P., 430-286-143 volt S.

1—300 KW., 575 volt, D.C., 370 volt, A.C., 600 R.P.M., complete with three 185 K.V.A., 60 cycle transformers, 2200 volt P., 370 volt S.

STEAM TURBINES

2—400 KW., West., 3600 R.P.M., 160 lb. Steam, 2300 volt, 3 phase, 60 cycle, complete.

1—1500 KW., G.E., Curtis, 3 phase, 60 cycle, 2300 volt, 3600 R.P.M. Complete.

1—500 KW., Allis-Chalmers, 2200 volt, 3 phase, 60 cycle, 3600 R.P.M, complete.

1—1000 KW., Allis-Chalmers, 600 volt, 3 phase, 60 cycle, complete with condensers.

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2—Hydro Electric units, each consisting of one 1200 H.P. double bronze runner, horizontal cylindrical Leffell Turbines, complete with Governors and Draft Tubes. Direct connected to each of these units are two 437 K.V.A., 3 phase, 60 cycle, 4400 volt, 300 R.P.M., G.E. Generators. Equipment is complete with Switchboard, Oil Switches, Instrument Transformers, etc. Equipment practically new.

1—Hydro Electric unit, 1200 H.P., as above, with one 875 K.V.A., G.E. direct connected unit.

PUMPS AND COMPRESSORS

1—1,000 gal. Underwriter Fire Pump.

1—800 ft., 30 lbs., Vertical Air Compressor.

1—600 ft., 30 lbs. Horizontal Air Compressor.

1—200 H.P., Worthington, 2 stage, 12-inch Turbine Pump, rated capacity 4000 G.P.M., at 60 lbs. pressure, direct connected to one 100 H.P., 3 phase, 60 cycle, 440 volt, 575 R.P.M., Westinghouse Induction Motor, complete with auto starter and no-voltage release.

1—1160 ft. Sullivan two stage belt driven air compressor complete.

1—1586 ft. Sullivan two stage belt driven air compressor, complete.

MISCELLANEOUS

2—Light Freight Car Trucks, splendid condition.

1—10-ton, 4 wheel double block steam locomotive, construction crane.

1—50 H.P. Foss Gas Engine, speed 200 R.P.M., one cylinder; flywheel 4 ft. x 12 in. Used only three weeks.

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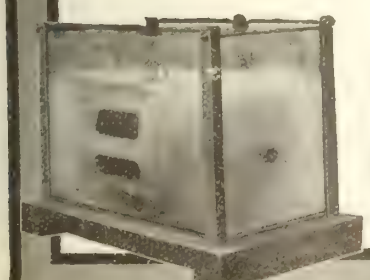
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	H.P.	Phase	Cycle	Volt	R.P.M.
Three	1	3	25	550	1500
Five	2	3	25	550	1500
Twelve	3	3	25	550	1500
Two	7½	3	25	550	1500
Two	10	3	25	550	1500
One	15	3	25	550	1500
One	20	3	25	550	1500
One	7½	3	25	550	750
One	10	3	25	550	750
One	15	3	25	550	750
Two	20	3	25	550	750
One	25	3	25	550	750
One	30	3	25	550	750
One	7½	3	60	550	1200
One	10	3	60	550	1200
One	15	3	60	550	1200
One	30	3	60	550	1200
One	75	3	60	550	1200

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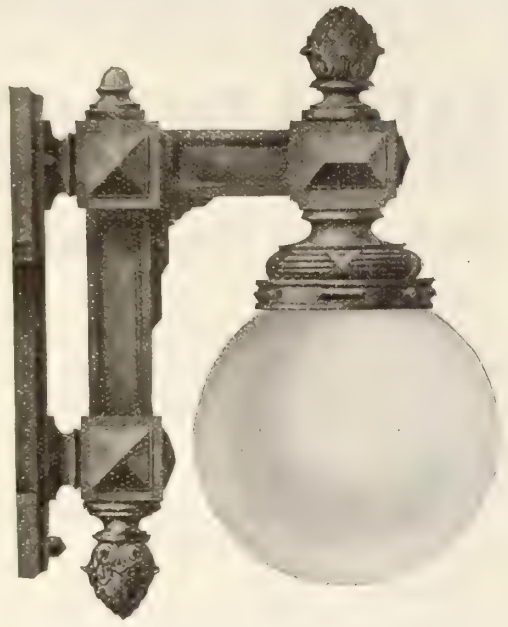
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3—15 K.W., 125 volt, 360 r.p.m., 4 poles, No. 10 SV frame, type "S" D.C. generators, vertical type, for excitation of above A.C. machines.

1—Four-panel switchboard with Tirrill regulator for control of above three A.C. generators and one feeder circuit. All of the above electrical machinery is of Westinghouse manufacture.

3—Trump pattern water turbines, vertical type, of 454 H.P., each under not less than 50 feet head, at that head using 6,000 cubic feet of water per minute, with an efficiency of 80 per cent. Also 3 cast iron heads with trash racks, 3 sections of 50 in.—¼ in. steel pipe between turbines and gate valve, 3 sections 50 in.—¼ in. steel pipe between trash rack and gate valve. 3—draft tubes 5 ft. long and 48 in. diameter.

3—Woodward Compensating governors for water turbines.

3—50 in. gate valves with bronze screw, nut, bronze seat and bronze face on valve where it comes in contact with seat, equipped with by-pass valve.

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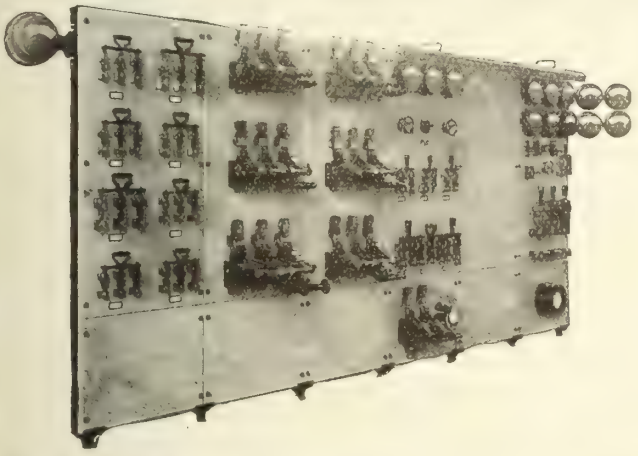
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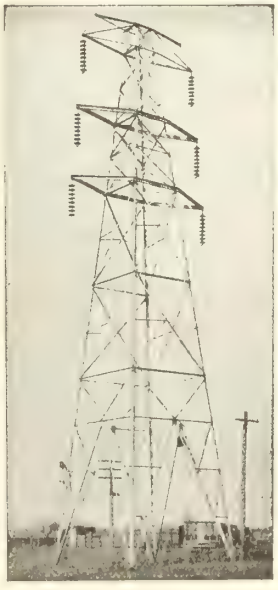
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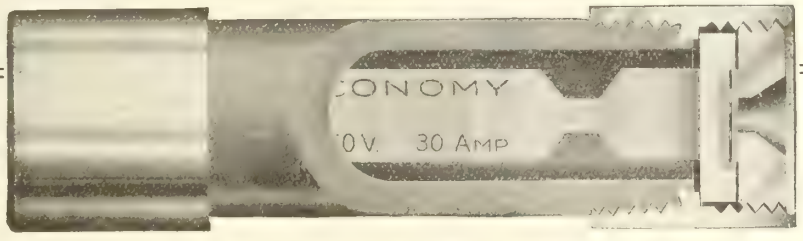
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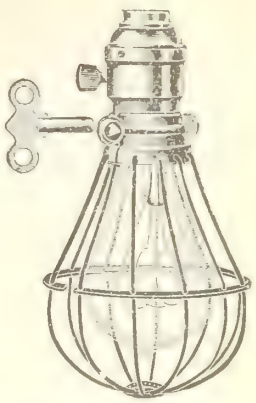
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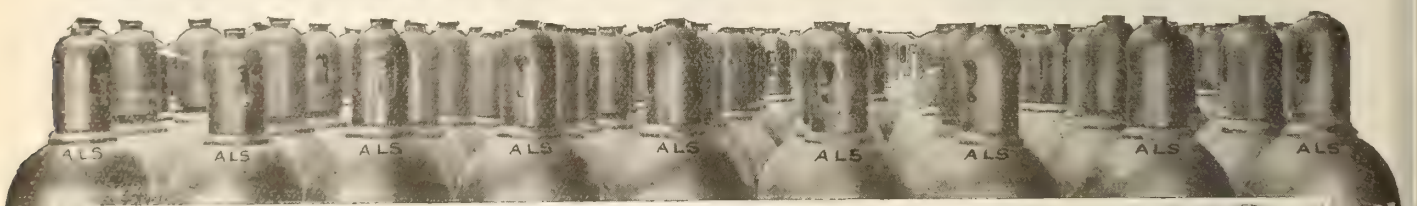
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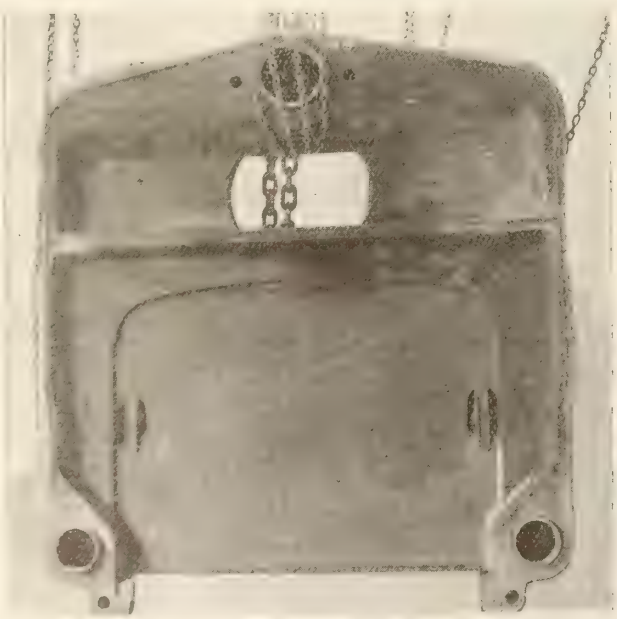
WELDING EQUIPMENT
Lincoln Electric Company of Canada

WIRE
Boston Insulated Wire & Cable Company, Ltd.
Canada Wire & Cable Company
D. & W. Fuse Company
International Nickel Company
Northern Electric Company
Phillips Electrical Works, Ltd., Eugene F.
Standard Underground Cable Company of Canada, Limited.

WIRING DEVICES
Canadian General Electric Company
Crouse-Hinds Company of Canada, Limited.
Hatheway & Knott, Inc.
Northern Electric Company



OXY-ACETYLENE WELDING & CUTTING



Boiler Section reclaimed by Oxy-Acetylene Welding

A National Necessity

Now that a maximum production and 100 per cent. efficiency are vitally important, the utilization of the Oxy-Acetylene Process is imperative in all industries upon whose production the future of Canada depends.

Tens of thousands of dollars are being saved daily by the reclamation of broken machinery and other discarded material by Oxy-Acetylene Welding, and its use gives greater strength and durability with freedom from future trouble in the joining of metals for all industrial purposes.

L'Air Liquide Society

The Pioneers of the Process throughout the world.

Toronto, Montreal, Winnipeg, Halifax

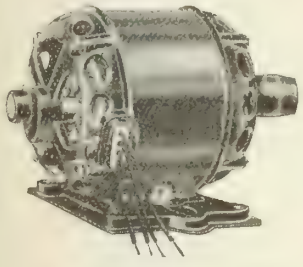
Fuse a small

Century

Repulsion—Start—Induction SINGLE PHASE MOTOR

1/10 to 1/4 H.P.

so that it will be properly protected under full load and that fuse will be of sufficient capacity to enable it to successfully start full load.



Illustrating a 1/6 H.P. Motor

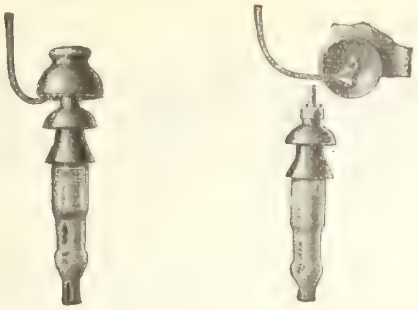
We build other sizes up to 40 Horse Power.

CENTURY ELECTRIC COMPANY

ST. LOUIS, Mo., U.S.A.

Stock carried in Canada by: 299

Jones & Moore Electric Co., Ltd., 294 Adelaide St. W., Toronto
Great West Electric Co., Ltd., Winnipeg
Rudel-Belnap Machinery Co., Ltd., Can. Express Bldg., Montreal
Rankin & Cherrill, 55 Hastings St. W., Vancouver, B.C.



Protected Disconection Terminal.

IF you are a user of cable terminals you should have a copy of our bulletin on Outdoor Cable Terminals (Type D.O.A.) In addition to terminals for ordinary light, power and railway service the following types for special uses are described:

Pipe Top Terminals
Protected Disconnection Terminals
Borehole Terminals
Small Telegraph or Pressure Wire Terminals
Third Rail Terminals
Mine Shaft Inverted Terminals

There are also complete tables of dimensions, weights, etc., and instructions for ordering and installing which should be in the files of all terminal users. Write our nearest office for your copy.

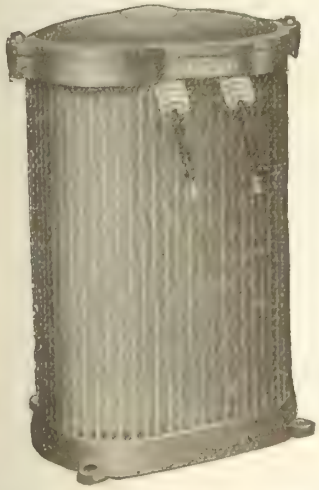
Standard Underground Cable Co.
of Canada, Limited
HAMILTON - ONT.

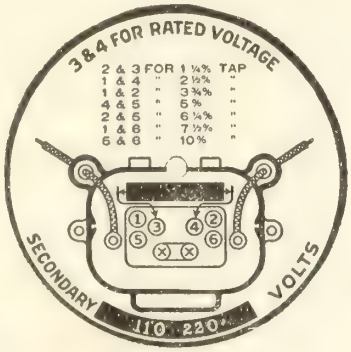
Montreal Toronto Hamilton Seattle

Moloney Service Transformers

are all supplied with brass plates fastened on the inside of the cover of each transformer; all connections marked plainly. They do not get covered with dirt or stained with oil like a blue print does. You always have them before you when changing taps. Heavy bushings eliminate breakages in shipment and handling

Moloney Transformers are manufactured in a factory that was built especially for that purpose only. They are designed by Engineers and built by men who make a specialty of this work.







Made in Canada

MOLONEY ELECTRIC COMPANY OF CANADA, LIMITED

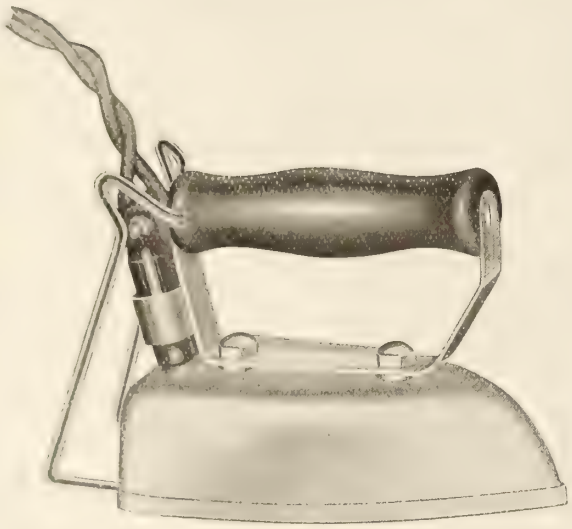
Factory Windsor, Ont.

Head Sales Office Bank of Hamilton Bldg., Toronto

Branch Offices Montreal, Halifax, Winnipeg, Vancouver

Westinghouse

Electric Irons and Turnover Toasters

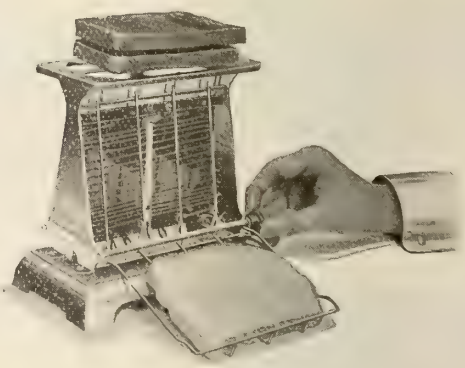




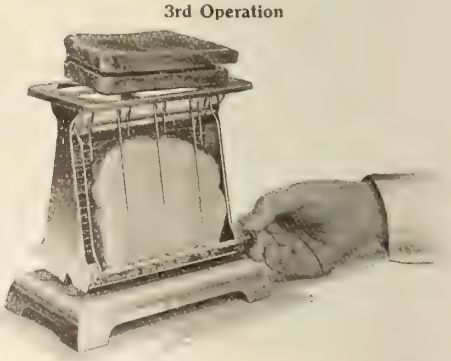
1st Operation



2nd Operation



3rd Operation



4th Operation

Two Profitable Leaders

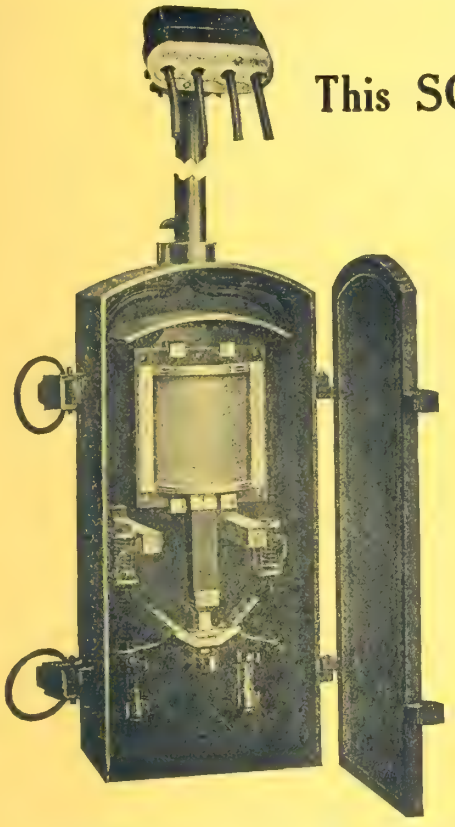
The Iron is practically indestructible, has no delicate pieces. All heat is given off at the ironing surface. Radiation from top is prevented by a dead-air space. A heat storage plate stores the heat, making it stay hot longer.

The Turnover Toaster besides turning the toast without danger of burning the fingers, acts also as a hot plate for keeping the toast, plates or coffee pot hot, etc.

Catalogue 8-C gives full description

Canadian Westinghouse Co., Limited, Hamilton, Ontario

Toronto	Montreal	Ottawa	Halifax	Ft. William	Winnipeg	Edmonton	Calgary	Vancouver
Traders Bank Bldg.	52 Victoria Sq.	Ahearn & Soper Ltd.	105 Hollis St.	Cuthbertson Block	158 Portage Ave. E.	211 McLeod Bldg.	Grain Exchange Bldg.	Bank of Ottawa Bldg.



This SOLENOID SWITCH has been adopted by the Hydro Electric Commission

They use it for

STREET LIGHTING

Now the fact that it is used by the Hydro-Electric Commission is proof that it is all we claim for it. It certainly is not an experiment, by the fact that it is giving efficient service in many towns throughout Ontario, as well as the other provinces.

No springs, swivels or other complicated mechanisms to give trouble. They close magnetically and are opened by gravity assisted by the tension of the laminated copper contact. All arcing is taken up on the carbons.

Increase the efficiency of your system and decrease the cost of installation by using our Type 17 H.E.P. Solenoid Switches, which are suitable for any frequency on multiple circuit or D.C. Series circuit.

Write for complete descriptive particulars

The Electrical Maintenance & Repairs Company, Limited

Phone Adelaide 902-903

162 Adelaide Street West
TORONTO

Nights Beach 1723-1930

Safeguard Your Lighting System

The Knife Switches used on the ordinary panel board are dangerous. Protect your employees by using—

Krantz Safety Panel Boards

The lights can be turned on and off without the slightest possibility of contact with live parts. The fuses are locked beneath the second door, and are reached only by authorized persons.

Besides being safe, these boards are very handsome in appearance and are an ornament to the building not an eyesore.

Send for complete descriptive catalogue.



Canadian Krantz Co., Inc.
TORONTO, CANADA

We have a large stock of

New and Used

Motors and Generators

FRED THOMSON CO., LIMITED

7-13 ST. GENEVIEVE STREET

MONTREAL

We extend a cordial invitation to the electrical fraternity to call upon us in our new building—the largest and best equipped electrical repair establishment in Canada.

G&W ELECTRIC SPECIALTIES

The Essential Details of G & W DISTRIBUTION BOXES

are very carefully perfected

In the primary box illustrated, switch blade action is combined with bolted contact efficiency

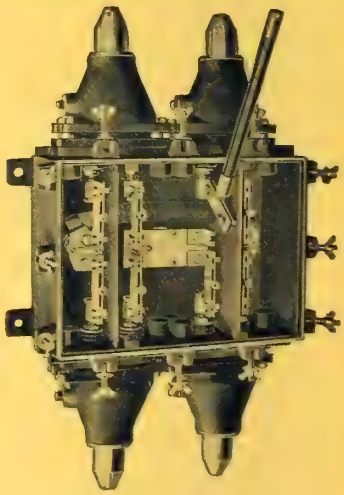
Unit cable potheads with ample compound space make an easy installation without sacrifice of safe, permanent cable end insulation.

The entire box is lined with insulating material—all bolt heads, etc., are covered and different polarities are thoroughly barriered.

In the secondary box double U clips give better contact alignment than would a single U clip.

The unit cable potheads attach at an angle, gaining roominess without using excessive wall space.

The line of this material is complete, offering constructions suitable for all conditions.



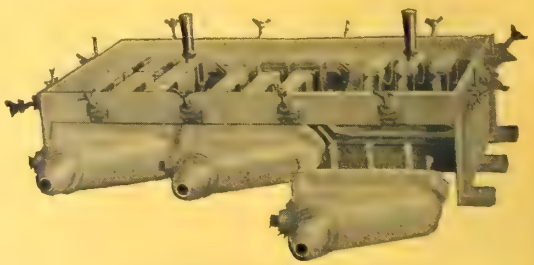
Primary Box for 2300 Volt Use

Let us quote you on your requirements

G & W ELECTRIC SPECIALTY CO.

7440-52 So. Chicago Ave. CHICAGO, U.S.A.

A. H. Winter Joyner, Ltd., 100 Wellington St. W., Toronto.
A. H. Winter Joyner, Ltd., 10 Cathcart Street, Montreal.
Bentz-Richardson Co., Ltd., 592 Notre Dame Ave., Winnipeg.
General Supplies, Limited, Calgary and Edmonton.



Secondary Box for Low Tension Use

Vol. XXVII No. 16 Toronto, August 15, 1918

Electrical News

Generation, Transmission and Application of Electricity

This is the sign and *name* of America's foremost Fuses

TRADE BUSS MARK

Buss Fuses

MAKE ELECTRICITY SAFE FOR MANKIND



Cartridge Fuses



Auto Fuses



Plug Fuses. Every type, size and capacity used in Electrical work.

EVERY Buss Fuse has been made with the thought and understanding that it must safeguard precious life and valuable property.

Every Buss Fuse is therefore made with infinite care; absolute accuracy.

Every Buss Fuse will hold an over-load of 10 per cent. indefinitely, and "blow" at 50 per cent. over-load in time limit allowed by Underwriters.

Expert test proves Buss the best. Used most extensively by Governmental and private engineers.

Canadian Trade Supplied
Direct from Toronto Branch.
ROSE & O'HEARN,
220 King Street West.

Catalogue sent only by request. Write for samples of any Fuse you are interested in.

BUSSMAN MANUFACTURING CO.
ST. LOUIS, U. S. A.

Supply Branches:
NEW YORK—731 Broadway. SAN FRANCISCO—221 Second St.
CHICAGO—627 W. Jackson Blvd. NEW ORLEANS—821 Union St.

Alphabetical Index of Advertisers, Page 8 Classified Directory to Advertisements, Page 50

Easier and Better House Cleaning



Northern Electric
VACUUM CLEANER



Appeals to the thrifty housewife because it means real economy in time, energy and health.

The extra large nozzle, specially designed nozzle brush, combined with the large fan and high speed motor make this cleaner, faster, more thorough and fully dependable.

Extra attachments make it possible to clean walls, picture moulding, draperies, upholstered furniture, pianos, etc., etc.

It is strong and durable. Weighs only twelve pounds.

Write our Nearest House for literature and full particulars to-day

Northern Electric Company
LIMITED

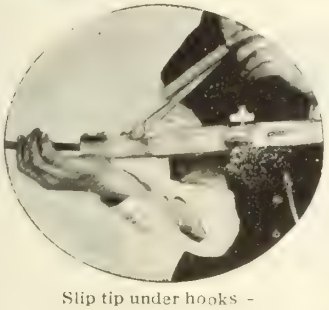
MONTREAL
HALIFAX
OTTAWA

TORONTO
LONDON
WINNIPEG

REGINA
CALGARY
VANCOUVER

O-B PRODUCTS

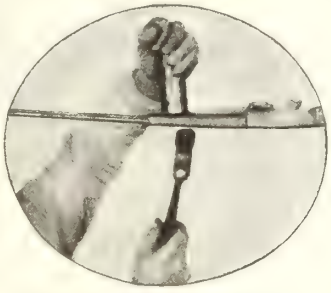
Quality First



Slip tip under hooks -



turn over and down on the wire -



clinch the lips and the job is done.

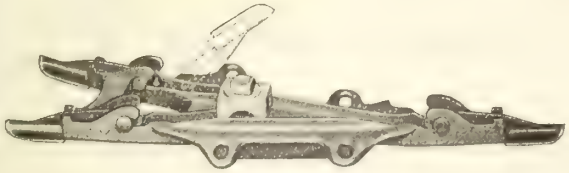
O-B TROLLEY FROGS PREVENT TRAFFIC DELAYS

Simplicity causes O-B Trolley Frogs to go up on the line with minimum delay to traffic. Their strength and endurance keep them there.

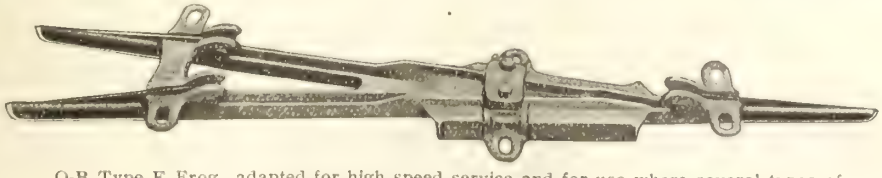
Trolley wires are anchored by a single powerful clamp secured in the Type E by two bolts, in the smaller Type D by one.

O-B Bronze Cam Tips form the approaches. The pictures show how easily they slip into place. These Tips make a smooth path for the wheel from wire to pan. It is easy to renew them.

THE OHIO BRASS COMPANY, Mansfield, Ohio



O-B Type D Frog, suitable for moderate speeds and all general city service.



O-B Type E Frog, adapted for high speed service and for use where several types of cars are operated over same line.

Send for "Saving Time on the Line." It describes the complete line of O-B Cam Tip Devices. : : :

"FLEXTUBE"

FLEXTUBE

The non-metallic, flexible conduit you should buy — for economy's sake and for your wiremen's sake. FLEXTUBE samples and descriptive Bulletin No. 151 sent on request.

National Metal Molding Co.

Manufacturers of

Electrical Conduits & Fittings

1118 Fulton Building, PITTSBURGH, PA.

Atlanta, Boston, Buffalo, Chicago, Buenos Aires, Dallas, Denver, Detroit, Portland, Havana, Los Angeles, New York, Philadelphia, St. Louis, Manila, Salt Lake City, San Francisco, Seattle, Paris

Canadian Distributors

CANADIAN GENERAL ELECTRIC CO., LIMITED

Head Office, - - - TORONTO

District Sales Offices:

Montreal, Halifax, Ottawa, Cobalt, Winnipeg, Calgary, London, Edmonton, Nelson, Vancouver, South Porcupine

Double Compounding  **Double Value**

F 8

ONLY GOOD GOODS ARE IMITATED

What flexible tubing do they try to imitate for its

Roller Bearing Wireway

?

Northern Electric
DURADUCT
Reg. Can. Patent Office

—of course!

Northern Electric Company
LIMITED

Montreal	Toronto	Regina
Halifax	London	Calgary
Ottawa	Winnipeg	Vancouver

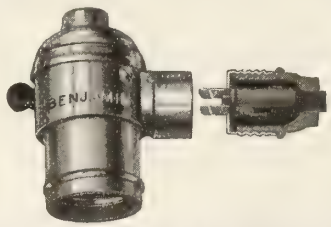
THE BLACK DOTTED LINE
IS THE MARK OF
DURADUCT

Make your plans now for the Convenience Outlet Campaign

Wire For Service As Well As Light

A Business Building Plan for Contractors

CONTRACTORS who include in their plans lighting outlets **only**, are losing an opportunity to build prestige and attract business. By installing outlets for appliances as well as for lamps, contractors give increased satisfaction to patrons as well as earn the good-will and co-operation of central stations.



Benjamin

Current Tap Sockets

help electrical contractors render this two-fold service.

This 2-in-1 socket has the appearance of an ordinary socket. But in addition, it has a receptacle for an attachment plug which is furnished with the device. It wins the users' appreciation by giving double the convenience of the usual socket. And it wins the support of central stations because it creates a market for electrical devices and helps the off-peak load.

Get the full facts about the Benjamin Current Tap Socket and other Benjamin prestige and business building electrical equipment.

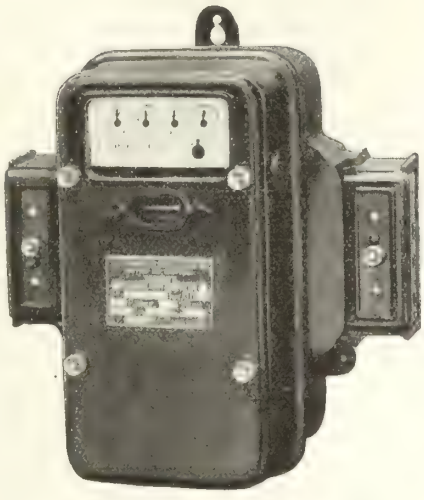
Benjamin Electric Mfg. Co. of Canada, Ltd.

11-17 Charlotte Street, Toronto, Canada

MAKERS OF
Benjamin
PRODUCTS OF CANADA

Absorbs the Shock

Our special C. & H. Poly-Phase Meter is safe because it is fitted with new double terminal blocks that absorb the shock and reduce the danger of accident resulting from overloaded wires and from surge conditions during lightning storms.



This meter also has more inside room for the connections, and the three or four lines are carried straight through the meter from the left to right. In every respect this C. & H. Poly-Phase is a Safety Meter, and is undoubtedly the one to select for Installation on Long Distance Transmission.

C&H Poly-Phase The Safety Meter

The Company's guarantee goes with every instrument. The new Poly-Phase is as near perfect as it is possible for a meter to be.

Get Full Information
Write the Makers

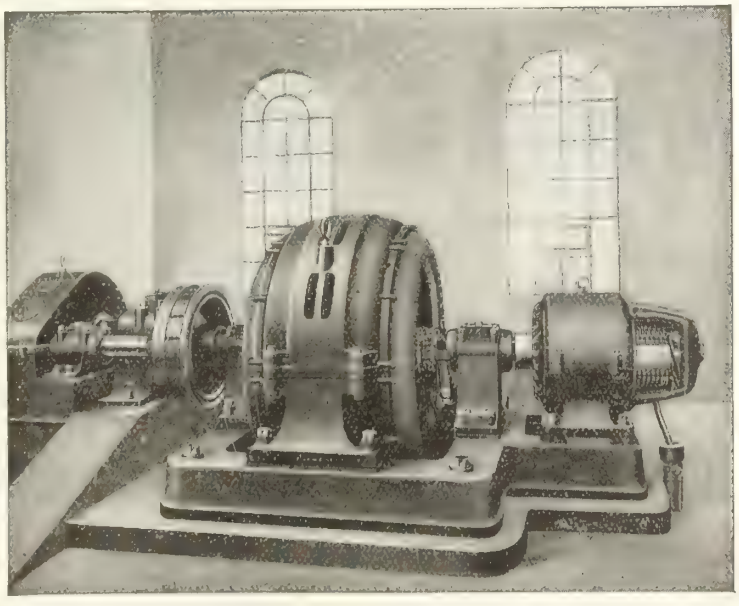
Chamberlain & Hookham Meter Co., Limited

243 College St., TORONTO 61 Albert Street, WINNIPEG
340 University Street, MONTREAL

We have a large stock of motors up to 100 H.P. in Toronto ready for immediate delivery

The "Lancashire" Ball Bearing Induction Motor and "Patent Reversing Drive for Metal Planers," will repay investigation.

Descriptive matter sent on request.



350 H. P. Self Starting Synchronous Motor Driving Colliery Ventilating Fan.

Accidents will happen, but a complete stock of spare parts and well equipped repair shop ensure users of "Lancashire" machines, minimum inconvenience from such breakdowns.

The Lancashire Dynamo and Motor Co. of Canada, Ltd.

Montreal 107-109 Duke St., Toronto

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THE "TYPE S" PORTABLE WHEATSTONE BRIDGE



Useful in the Shop and Laboratory for the Measurement of Resistance. Adapted for Fault Locations in Telegraph and Telephone Lines and Cables.

The Type S Bridge is a thoroughly practical instrument for shop and field use. Being complete in every detail it is ready at all times for immediate use. It is easily portable, its weight being but 8 pounds. The precision of adjustment of its coils (Rheostat 1/10 per cent., Ratio 1/20 per cent.) insures accurate measurements. The galvanometer, the weakest element of such an instrument, is unusually rugged. It is a separate element and may be removed for examination or repair by taking out two screws. The battery is of the ordinary "flash light" type, and renewals may be procured practically everywhere. The price is $66.25 net, f.o.b. Philadelphia, boxed for shipment.

Bulletin No. 530 describes this instrument.

THE LEEDS & NORTHRUP CO.

Electrical Measuring Instruments

4912 Stenton Ave. PHILADELPHIA, PA.

TULLMAN FLOOR OUTLETS

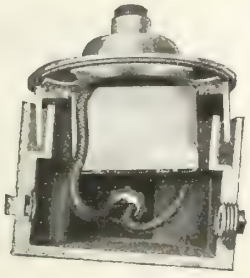
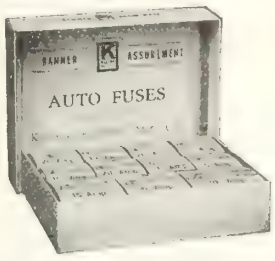


Fig. 104
Sectional view of No. 421 Outlet and No. 466 Nozzle with Bryant Receptacle No. 1363 and Plug No. 1110 mounted on lugs of Adjusting Ring.
Quarter Actual Size.

NO MORE BULLETINS
Our new complete catalog No. 33 just off the the press. Yours for the Asking.
"THE QUALITY LINE"

STEEL CITY ELECTRIC COMPANY
1207 1219 Columbus Ave. PITTSBURGH, Pa.

"BANNER" ASSORTED CARTON



This is a small, compact, carton giving a very good assortment at low cost. It contains 100 glass tubing cartridge type fuses, assorted as follows:

30 No. 1AG—20 amp.	15 No. 3AG—15 amp.	5 No. 5AG—15 amp.
5 No. 2AG—15 amp.	10 No. 3AG—20 amp.	5 No. 5AG—30 amp.
5 No. 2AG—20 amp.	5 No. 4AG—10 amp.	5 No. 6AG—20 amp.
5 No. 3AG—10 amp.	10 No. 4AG—15 amp.	Total List $7.00

The fuses in all Killark assorted cartons are packed in little individual cartons, with contents clearly marked, preventing all possibility of error.

No charge is made for these cartons—the list prices represent the cost of the fuses only.

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HIGH EFFICIENCY—
LOW CORE and COPPER LOSSES

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House Service and Power Meters, Ammeters, Voltmeters, Current and Potential Transformers supplied from stock.

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Railway & Power Engineering Corporation

Limited

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We Manufacture in Canada the following Equipment:

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The Fraser Patent Threadless Pipe Fitting

This fitting is a new device and saves a large percentage of the labor cost on installation of any pipe frame work, for switchboards, switch and bus structures, and greatly improves their appearance. This device is also ideal for Architectural and Marine use for pipe railings, etc.

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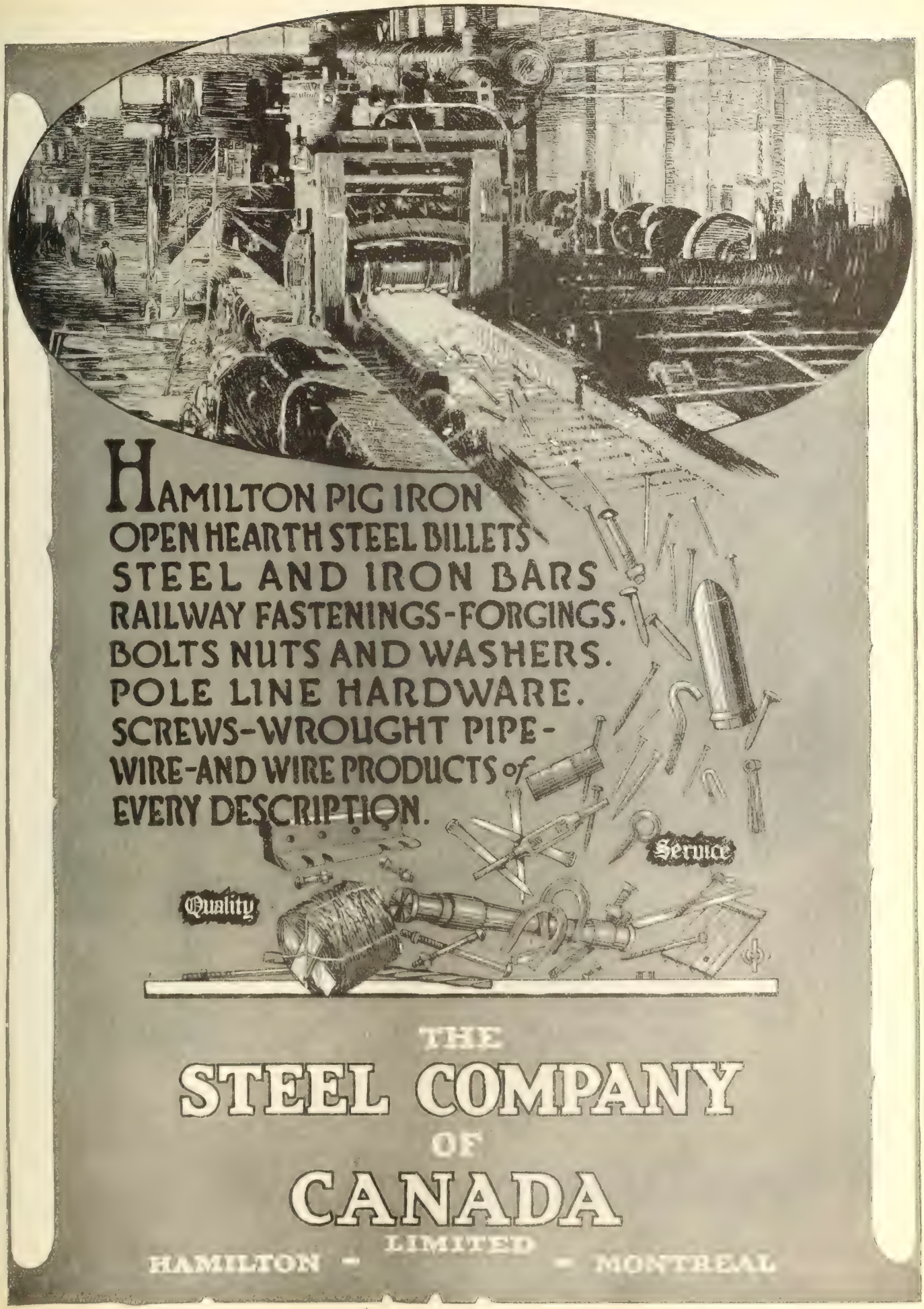
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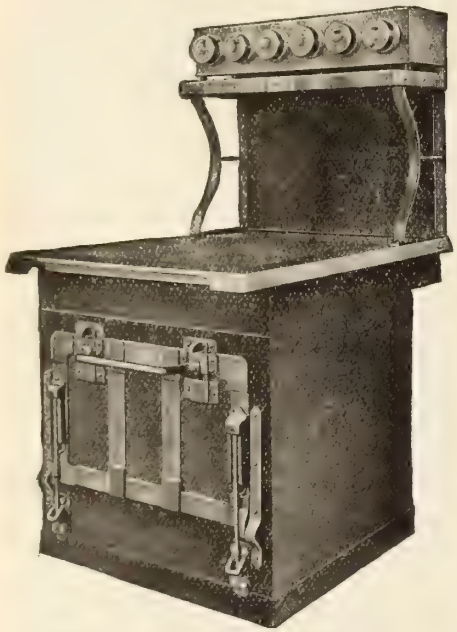
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For Hotels, Restaurants, Clubs, Factories, Hospitals, Mess Kitchens

There is no place where electric cooking has been more successful than in large kitchens. Modern hotels and restaurants are fast replacing coal and gas equipment with this substantial apparatus and large schools and hospitals are profiting through their installation.

The Neuco way of cooking means better cooking. Emile Bailly, the famous chef at the St. Regis Hotel, New York City, in speaking of the Neuco electric cooking appliances installed there, said, "This range helps to make the St. Regis cooking distinctive in quality and flavor." This statement is conclusive evidence that Neuco results are perfect.



NEUCO ELECTRIC HOTEL RANGE

Neuco hotel ranges are heavily built to stand the severe usage of commercial cooking. They are compact and convenient, fit back to back and side by side to make any suitable arrangement of units. Additional units may be installed at any time to increase the capacity of the installation.

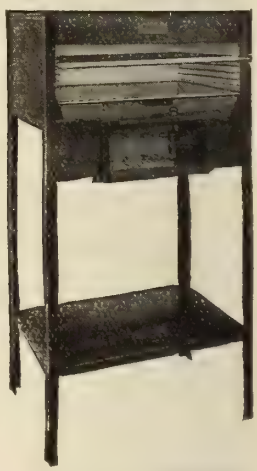
The Range shown is not only a strong and practical electric range, but its outward appearance is very attractive. The drop doors are protected by spring balances with positive catch, the wrought iron being re-inforced at all joints and hinges.

It is a complete range in itself. Additional units may be placed side by side or back to back to meet the requirements of any size kitchen.

In the broiling of meats, fish and birds, Neuco broilers are fast replacing other means. The perfect cleanliness of the operation, the saving of fats for other uses, the convenience and speed with which the work is done, are factors in Neuco success.

The meat is supported horizontally and the juices are retained. Vertical support of broiling meats allows the juices to drip off, leaving the meat dry and tasteless.

Control of temperature is effected by a single switch. Each unit is fused.



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PORTABLE LAMPS

Two Push Sockets

6 feet of Silk Cord and Plug

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Height 22 inches

Diameter of Shade 16 inches

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Announcing—our Special Portable Lamp for Fall Business. Note the specifications and write our nearest office for prices which will amaze you.

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Now is the time to order for the Fall Trade

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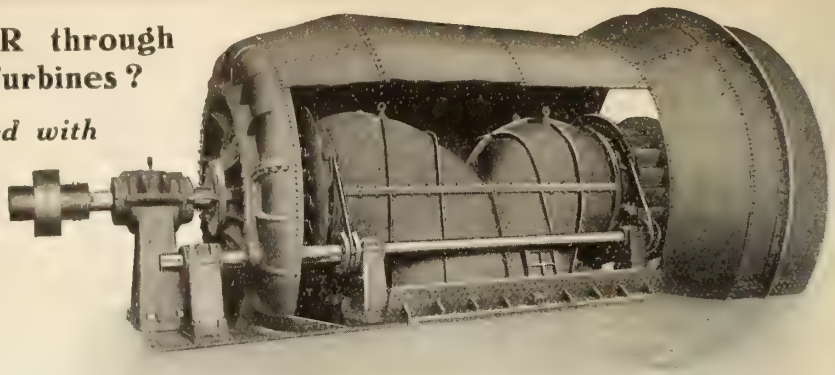
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Maximum Efficiency Assured with

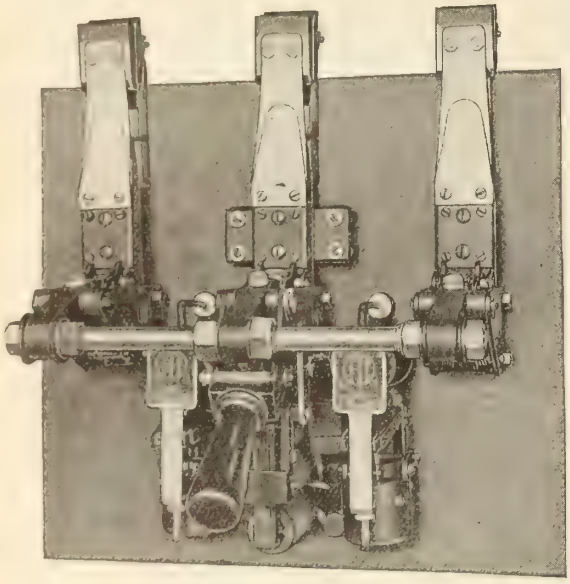
"SMITH" HYDRAULIC TURBINES

The accompanying illustration shows a horizontal shaft unit of 2000 H.P. capacity under 42' head. Write Dept. "N" for Bulletin.



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YORK, PA.
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TYPE W
Non closable on overload. Direct acting, time limit and "No Voltage."

For motor protection, especially A.C., 440 volts or less, the

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has advantages not possessed by any other piece of apparatus. This is why one concern recently ordered over two hundred of them.

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Will stand 30% to 50% MORE STRESS than the Welded Eye

Delivery from Stock. **Plain or Hot Galvanized.** **Get Our Prices**

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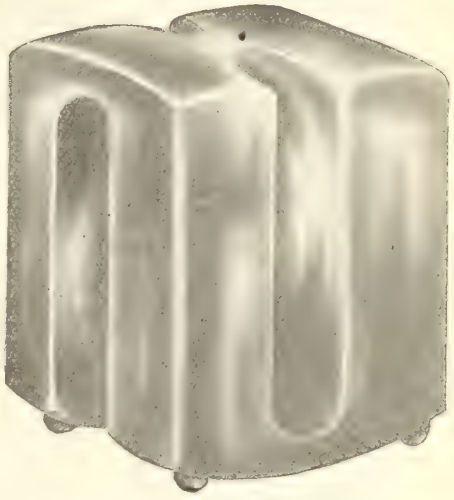
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This is the kind of strains T. C. White Company is making of porcelain in a variety of sizes for different loads, and several designs for varying conditions.

It will pay you to write for bulletin which shows designs and gives the complete data on strain and electrical tests.

Write today.



Type No. 600

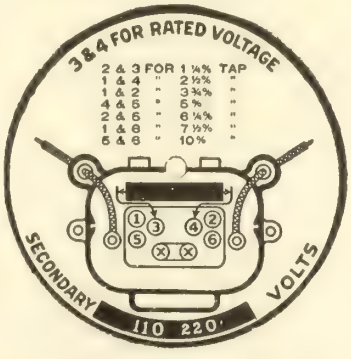
T. C. White Electrical Supply Co., 1122 Pine Street, ST. LOUIS, Mo.

Moloney Service Transformers

are all supplied with brass plates fastened on the inside of the cover of each transformer; all connections marked plainly. They do not get covered with dirt or stained with oil like a blue print does. You always have them before you when changing taps. Heavy bushings eliminate breakages in shipment and handling

Moloney Transformers are manufactured in a factory that was built especially for that purpose only. They are designed by Engineers and built by men who make a specialty of this work.







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The Great Lighting Economy



Wiremold is what the electric lighting world has been seeking: a convenient, safe and economical means of conveying.

Light to Any Desired Spot

Wiremold is wanted in the home, office and factory. It is the essence of lighting convenience and its saving of current is the logical answer to the demand for

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It does not mar the buildings it serves. It beautifies them and its ingeniously arranged extensions can be connected by anyone.

Figure for a moment on the wide field of possibilities Wiremold as a sales maker opens up for you. This field is illimitable. Not only has the use of Wiremold become essential, but it carries with it the introduction to all the electrical goods you stock.

Let This Special Trial Order Lot Convince You

It has been arranged for your first order and contains 100 feet of WIREMOLD and a unit package of each of the 15 fittings—all that is necessary for any average job. The special lot will be forwarded to you on receipt of your cheque for $24.96.

Associate your business with Wiremold. Get it in front of your customers and you will reap a harvest of sales from a lighting improvement that every consumer will and must recognize as a necessity. We have abundant advertising literature to assist you. Make full use of it, and GET THE TRIAL ORDER WITHOUT DELAY.

The books shown here will prove valuable to you by their useful information, and illustrated use of Wiremold. They, with other forms of advertising literature, have told the simple story of Wiremold to tens of thousands. A postal brings them by return.

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A "Galvaduct" Building

"GALVADUCT" and LORICATED

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The most perfect interior construction conduit on the market.

Recognized as the standard of high quality.

Always specify Galvaduct or Loricated

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A high-class interior construction conduit of the enamelled type, proof against acid or other corrosive agents.

If your jobber cannot supply you—write us.

CONDUITS COMPANY

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TORONTO

Standard Package Assortments

—OF—

Decorated and Etched

Illuminating Glassware

Illustrated in Catalogue No. 6

Selected from the best sellers in the line



In order to make it easy for our customers to *carry in stock* our Color Decorated and Etched Shades we have made up Standard Package Assortments of 6 dozen Shades—12 different designs—6 pieces of each



Also Standard cases containing 6 Decorated or Etched Bowls each one different

Full particulars on application *Order now for Fall delivery*

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FRANKLIN
Bus Bar Supports

INSTALL THE "FRANKLIN" AND FORGET IT!
ELECTRICAL DEVELOPMENT AND MACHINE CO.
TRADE MARK
GENERATING STATION EQUIPMENT

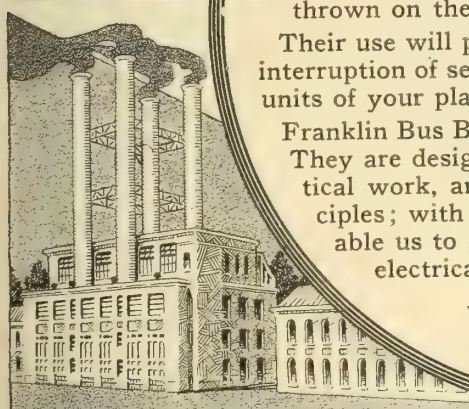
SAFEGUARD YOUR BUS BARS

They support your bus bars so strongly that they can't possibly breakdown, no matter what load is thrown on them.

Their use will protect you and your customers against interruption of service, no matter what other individual units of your plant may break down.

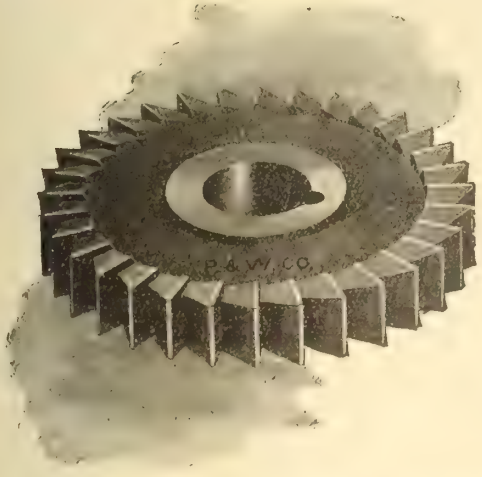
Franklin Bus Bar Supports have no flashover points. They are designed by practical engineers on practical work, and built on sound mechanical principles; with unique patented features that enable us to guarantee their service. Stronger electrically and stronger mechanically

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Milling Cutters

Taps **Dies**
Reamers **Drills**

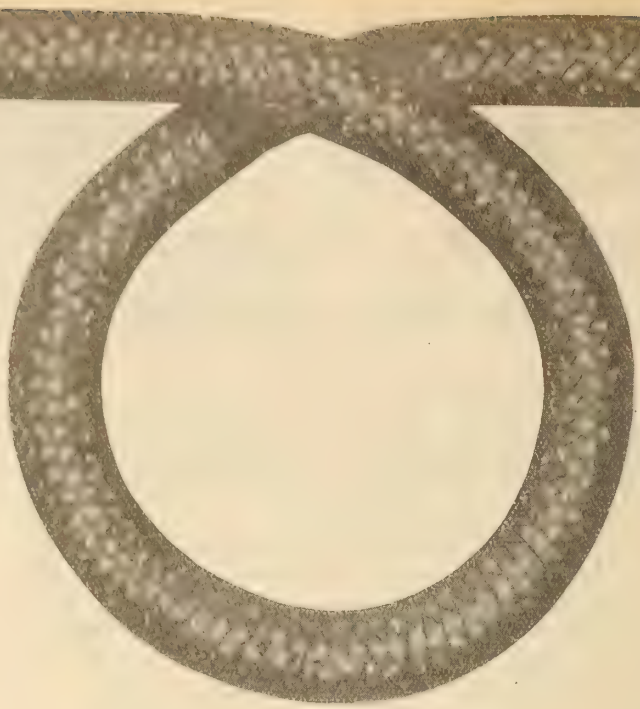
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Kraft Cord "Braiduct"

Made in Canada under Canadian Patent No. 147,057

This cut is reproduced from an actual photograph, and illustrates the behavior of the material in this rigid test—perfect flexibility. We cut the ends to show plainly the superior construction—note the high grade Canvas Duck Lining and the KRAFT CORD winding. This KRAFT CORD is made to our own specifications and is fire-proofed, which is entirely new.

KRAFT CORD "BRAIDUCT" is in a class by itself—superior to any imported conduit—is absolutely the last word in flexible non-metallic conduit construction.

We are now making our own insulating compounds, consequently every lot will be uniform in flexibility, and every foot is fished at the factory.

KRAFT CORD "BRAIDUCT" is easy to instal—easy to cut—easy to secure, as it is made in our own country, and easy to buy, as our price is right

KRAFT CORD "BRAIDUCT" is regularly inspected and labelled by the **Underwriters' Laboratory** under the direction of the **National Board of Fire Underwriters** and every coil carries their label.

We will be glad to send you a sample.

The Flexible Conduit Co.

Limited

Guelph - Canada



Her Good Will is Your Best Sales Help

Every woman who is getting satisfactory service from her fan, suction sweeper, washing machine and heating devices, becomes a very effective sales aid for the electrical dealer, contractor and central station,

This is especially true to-day when household servants are difficult to obtain and women are making greater use of electrical aids to replace them. The woman who is getting reliable service from her electrical household helps is always an enthusiastic booster for them when discussing the housework problem with her friends. Electrical Dealers and Central Stations find that it pays big to make sure that their customers buy those devices which are absolutely dependable and which earn the goodwill of every user.

Devices equipped with R & M Motors can always be depended upon to give service which makes satisfied customers and brings orders from the customer's friends. And they have the additional advantage that the R & M Motor is advertised dominantly in the leading magazines. Its reliability is known to practically every prospective user of motor-driven devices. Leading household devices of all kinds can be obtained with R & M Motor equipment.

THE ROBBINS & MYERS CO., SPRINGFIELD, OHIO.

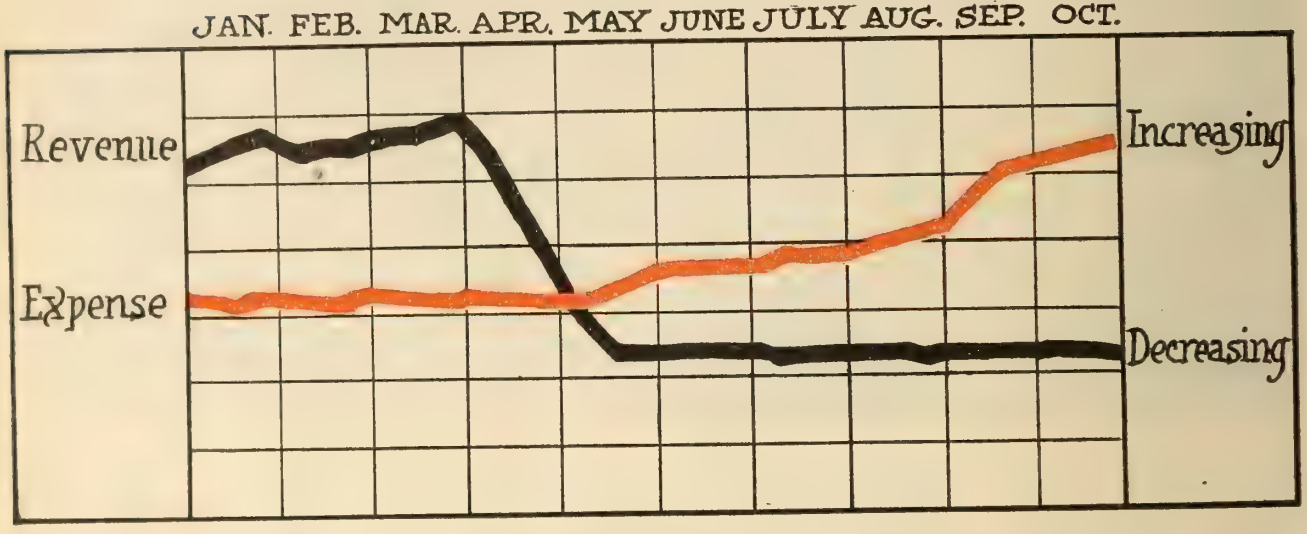
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The Solution:

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boosts the load where it needs boosting and brings back to normal the ratio of expense to revenue.

Furthermore, with the new daylight saving plan the central station's peak has shifted, thus making the cooking load even more attractive.

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Generation, Transmission and Application of Electricity

Published Semi-Monthly By

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Subscribers are requested to promptly notify the publishers of failure or delay in delivery of paper.

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Vol. 27 Toronto, August 15, 1918 No. 16

Heavy Depreciation and Low Labor Efficiency

Particulars of the large depreciation in the value of obsolete cars were given by Mr. David E. Blair, C. E., the superintendent of the Montreal Tramways Company, during the hearing of the appeals to the Quebec Public Utilities Commission against the proposed increased fares. The Tramways Commission has issued a schedule of fares, the main feature being a 5c fare with 1c transfer; against this the City of Montreal and others apepaled, while the Tramways Company on its part asked for a 7c fare with free transfers. The Company submitted a mass of information to show that it would be impossible to run the cars at a profit unless this increase was granted.

Mr. Blair told of how the efficiency of labor decreased notwithstanding that wages increased. When a car became obsolete the Company burned it, and sold the parts as scrap. Only about 2 per cent of a car could be salved, ten per cent of the trucks and 9 per cent of the motor equipment. In a recent car scrapped the figures were: Former value $3,350; cost of body, $1,500; cost of electrical equipment, $1,200; cost of truck, $350; cost of assembling these, $250; scrap value of the body, $35; scrap value of the electrical equipment, $100, $50 for each motor; scrap value of the truck, $35; and perhaps $20 for all other parts, $190 in all. The Company believed that the salvage just paid the cost of scraping. At present prices cars were bought for $15,000 and in 1914 for $8,000. Each car was supposed to run about 40,000 miles a year. The company had now 1,150 passenger cars and 73 freight cars.

Lieut.-Col. Hutcheson, the general manager, Mr. W. F. Graves, the chief engineer, and Mr. A. S. Byrd, superintendent of power plants, also gave evidence, the first named stating that in his opinion, the proposed increase in fares would result in a decrease of 7 per cent, in traffic. The earnings of the company had been adversely affected by reason of so many young men joining the army. The cross-examination on behalf of the city was directed to show that the estimates of increased expenses by the company were excessive.

Progress in Electric Illumination

The general trend of practice for direct lighting is very decidedly toward units of low brightness. The extended use of the high-powered incandescent lamps has stimulated the appreciation of good diffusing devices which will give satisfactory light distribution but by their low brightness minimize glare. The enormous increase in commercial activities, particularly in those lines which are connected with supplies for the Government, has made night work the rule and brought a realization of the importance of proper illumination from the standpoint both of the maintenance of quality and quantity in production and of the health and comfort of the worker. Progress toward this end is evidenced in the revision of industrial lighting codes in several states and by the appointment of a National Committee on Lighting to act as a sub-committee of the Advisory Commission-Council for National Defense for the preparation of suggested regulations to govern industrial lighting, which have subsequently been published in the form of a Code of Lighting by the Committee on Labor.

War conditions have also brought about a more careful consideration of protective lighting and the best way to utilize it. Thus it has been found that in many cases inexpensive reflectors of the ordinary type may be used for lighting open spaces in and around a plant leaving the special flood lighting units for those locations requiring particular treatment. In many cases the use of a large number of properly shaded low-intensity units will avoid dangerous shadows better than high powered sources, even though the light flux from the latter is greater.

A sphere formerly considered impregnably held by the arc lamp has been finally invaded by the incandescent lamp. Motion picture projection work required light flux of extremely great intensity and the small area and high intrinsic brilliancy of the source of light in the arc has enabled it to meet the requirements in a way hard to duplicate. By using a mirror back of the filament and for a condensing lens one of the Fresnel type, it has been found possible to make an incandescent lamp which will give satisfactory results within a certain limited field of motion picture work.

The motion picture theatre has in itself become an arena in which unique lighting effects are being experimented with continuously. Thus in several cases, by the use of several circuits in each fixture, lamps of different colors may be lighted and thereby give a color to the whole illumination.

The action of the Government in attempting to save fuel by restricting its use for lighting purposes has shown in many localities the important part played by display lighting in maintaining the illumination of streets and sidewalks.—Report of A. I. E. E. Lighting Committee.

The City of Verdun, P. Q., has inaugurated the new underground conduit and lighting system, already described in our columns by Mr. A. S. Clarson, the city engineer. The lighting system, which is located on the three principal streets, was installed by the Northern Electric Company.

Electrical Industry in the Enemy Country

A report on "German Trade and the War," published by the U. S. Department of Commerce, says in regard to the electrical industry.

The electrical industry is concentrated in the hands of a few gigantic firms or combines which are related or have working agreements, so that the exploitation of foreign business is greatly facilitated. The Allgemeine Elektrizitats-Gesellschaft of Berlin, capitalized at 155,000,000 marks, has branches all over the world and also working agreements with large electrical undertakings abroad, and the other large concerns, Siemens-Halske and Siemens-Schuckert, have similar connections. In 1913 the exports of electrochemical products from Germany were valued at $69,082,000. The chief products exported were appliances for illumination, transmission of power, electrolysis, etc., valued at $17,623,000, and incandescent lamps—chiefly metallic-filament lamps—valued at $11,451,000. In 1912 Germany produced 97,161,000 incandescent lamps, imported 2,294,000, and exported 58,339,000. The exports declined somewhat in 1913. The electric concerns have also worked for military needs, and the Allgemeine Electrizitats-Gesellschaft was able to increase its net profits during the first year of the war to 26,570,000 marks, as against 18,163,000 in 1913-14. The net profits for 1915-16 were 26,487,000 marks, and for 1916-17 29,574,000 marks. The capital of the company was increased to 184,000,000 marks in 1916-17. The shares of the company were quoted at 232 at the end of 1917.

The electrotechnical factory of Max Schorch at Rheydt, which had been paying 8 per cent during the years 1910 and 1913, increased its dividend to 12 per cent in 1914. The factories of the company were fully employed during the war, night shifts being necessary at times. In 1915 the turnover was five times as large as in the preceding years, and the company distributed a dividend of 20 per cent. with a bonus of one new share for every two old shares, thus really paying a dividend of 70 per cent.

In Bavaria and Saxony steps have been taken to make the production of electric power a state monopoly. This action would seem to make impossible the institution of an imperial monopoly of electricity.

In December, 1917, the government of Prussia announced its intention to build a large central plant in Hanover for the production of electric energy. The initial production is estimated at 50,000,000 kilowatt-hours. The state is ultimately to monopolize the production of electric energy, though not its distribution. The existing private and municipal works may remain in operation, and the state is to seek close co-operation with them.

A Big Electric Picnic

A representative gathering of Toronto electrical men met in the Engineers' Club on Tuesday, August 13th, to talk over, in a informal way, the prospects and possibilities of a huge picnic, to include all men connected with the electrical industry in Toronto and vicinity. It had been hoped that conditions would favor holding such a picnic this autumn, probably within the next couple of weeks, but Mr. Frank T. Groome, who occupied the chair, in summing up the expressed opinions of the members present, concluded that it would be a great mistake to run any risk of failure by hurrying the matter forward unduly, and that it would apparently be in the interests of the industry to proceed deliberately, so that the picnic organization may be as nearly perfect as possible. It was therefore decided to call a general meeting at some later date in the near future, at a time convenient to all, so that a thoroughly representative gathering may have an opportunity of discussing the whole situation. The opinion was freely expressed that under proper conditions there should be little difficulty in getting three or four thousand people (including the wives and children) together, and with this object in view the meeting was temporarily adjourned. It is possible the matter may be discussed before the Electric Club of Toronto, when it meets again this autumn. Committees should be arranged early and a complete organization set going so that every detail may be worked out properly without any undue haste. It may be said of the idea of a monster picnic, that it met with the approval of every member present, and there should be comparatively little difficulty in making the suggestion a reality some time during the summer season of 1919.

New Plant for Pulp Company

A special general meeting of the shareholders of the Riordon Pulp and Paper Company has been called for September 10 in connection with the financing of the new plant of the Kipawa Fibre Company, Limited, which the Riordon interests will operate. The circular issued in this connection says, in part: "At the last annual meeting the directors reported that the company had undertaken the establishment of a mill at Temiskaming, Que., for the manufacture of bleached sulphite pulp. The site has been purchased, water power and timber rights secured and the construction of the mill is well under way. This new mill will be constructed and operated by the Kipawa Fibre Company, Limited, which will be managed jointly with your company and have the advantages of our experience in manufacturing and facilities for marketing the product. In addition to the investment to be made by your company, which will ensure permanent control and a large share in future profits, your directors have decided that it is advisable to secure a further sum of approximately $3,000,000 for investment in the new company, and subject to the approval of the shareholders, tentative arrangemetns have been made for the sale of bonds or debentures, particulars of which will be announced in due course, after the requisite legal formalities in connection with the issue of the securities have been completed."

Transmit at 140,000 Volts

The Consumers Power Co. has recently completed a hydro-electric plant in the state of Michigan which, though rated at only 16,500 kw., is being operated with a transmission voltage of 140,000 over a 100 mile line to Grand Rapids. This, we believe, is the highest transmission voltage on record for any considerable amount of power. Transmission is at 7,500 volts and the 7,500/140,000 transformers of 5,000 kv.a. capacity are Westinghouse manufacture. On each transformer are 120,000 volt to 140,000 volt taps arranged in 5,000 volt steps. The 140,000 volt oil switches which are type G.2, 300 amp. units, are non-automatic, solenoid-operated and set on concrete foundation. The 140,000 volt electrolytic lightning arresters, with their horn-gap structure, are also on concrete foundations and are served by a cone-stack derrick.

The War Labor Board of the United States have just awarded wage increases to the employees of street railways in 16 cities, including Chicago, Detroit, Cleveland, Buffalo and Rochester. Increases in fares are to be granted whereever they may be necessary to meet advanced costs of operation.

The minting of a six cent coin is a possibility in the United States for convenience in paying the six cent fare now charged on so many electric railways.

A Review of Recent Electrical Engineering Progress

By E. W. Rice, Jr.*

In the early days the progress of the electric science and arts was so rapid that it was relatively easy to find each year plenty of material for a review. Progress has continued and will continue, but naturally a decided tendency to saturation is shown in many directions. In some instances, this saturation can be demonstrated to be due to the fact that limits of perfection have been so closely approached that little remains of possible accomplishment. In other instances the slowing up is due to lack of knowledge, or, especially at the present time, to lack of workers, such workers having been diverted to the work imperatively needed to secure us against the attack of our enemy on the foundations of our existence.

There has been no material improvement for several years in the matter of efficiency in electrical units, such as dynamos, motors, transformers, etc. The efficiencies stated in Past-President Lincoln's address, in 1915, still remain almost exactly of the same values, and for the reasons which he so clearly pointed out.

The efficiency of conversion of mechanical into electrical energy, or the reverse, of electrical into mechanical energy, is still about 90 per cent in the average case, under practical conditions of operation; the efficiency reaching as high as 97 per cent or 98 per cent in the most favorable cases, with the large units, and falling below 90 per cent in unfavorable cases, or in the small units. The efficiency of conversion of electricity from high to low potential, as in transformers, also remains substantially the same, reaching as high as 98 plus per cent in the largest units. It is obvious, as Lincoln pointed out that no material change can be expected where such practical perfection has been reached.

Increase Efficiency in Converting Water to Electric Power.

The conversion of mechanical power of falling water into electrical energy by our water-wheels and electric generators has increased from about 87 per cent to 90 per cent in the largest units of 40,000 h. p. This represents about the limit which may be expected.

In the field of thermodynamic engines, represented largely by the steam turbo-generator unit, some improvement has been obtained. Lincoln stated that 75 per cent of Rankine efficiency had been obtained in some large modern steam turbo units in 1915. This has now been increased to about 80 per cent is quite common practise even in such moderate sized units as 10,000 kw. This improvement, while not large is doubly important because of the great increase in the cost of fuel. It has been realized mainly by bringing the practical design more nearly in accord with the theoretical, by increasing the number of stages or processes of steam extraction, reducing various losses, and by improving many details which, when properly looked after make in the aggregate, gains of practical importance.

Increase in the initial pressure of steam and lowering of terminal pressure, by better condenser arrangements, have also contributed to improvement, as it enables an increase in the range of temperature to be utilized. This makes possible better thermal efficiencies, even with the same per cent of Rankine efficiencies.

The following information illustrates the improvement in efficiency of turbo-electric units beginning with the first 5000 kw. installed in this country, in 1903, and continuing up to the close of 1917:

Year	Size, kw.	Steam Conditions: Steam pressure	Superheat fahrenheit	Back pressure	Lbs. per kw-hr.	Per cent. of rankine efficiency
1903	5,000	175 lb.	0	2 in.	24.00	37.8
1908	14,000	200 lb.	125°	1½ in.	13.50	66.1
1911	20,000	235 lb.	100°	1½ in.	13.20	67.0
1913	20,000	200 lb.	200°	1 in.	10.74	75.9
1916	20,000	250 lb.	250°	1 in.	10.00	76.5
1917	35,000	230 lb.	200°	1 in.	10.14	78.7

It is gratifying to note that a percentage of Rankine efficiency of approximately 80 has been reached. This progress reflects great credit upon the designers of turbo-electric machines and is a record of achievement found only in electrical development.

Improvements in Steam Producing Devices.

Concurrently with this improvement in the turbo-electric machines, great advances have been made in the design and operation of steam producing devices—the boilers, and in auxiliaries and other features of the modern power station. As a result the thermal efficiency has been rapidly improved. The thermal efficiency to which I refer may be stated as the ratio of the total energy produced at the terminals of the generator, to the total energy in the fuel burned—expressed as a percentage. It takes account of all losses from the coal under the boiler to the electricity at the dynamo terminals. It is the ratio of the heat units equivalent to one kw.hr., divided by the similar heat units in the fuel consumed to produce one kw-hr. at the generator terminals.

This thermal efficiency is after all, to the electrical engineer, the most important measure of progress. It measures the advance in station fuel economy, and as stated, many factors in addition to the improvement in turbo-generators have contributed to the result. Thermal efficiency may obviously be used to express the results of a single unit, consisting of turbo-generator, with its bank of boilers and other accessories, or it may be used to designate the combined result of all the units in a given power station.

The progress in the case of a combination unit, i.e. turbo-generator, with its boilers, auxiliaries, etc. has been as follows:

Year	Size of unit kw.	Thermal efficiency per cent.
1903	5,000	10 15
1908	14,000	15
1913	20,000	18
1917-18	35,000	21.6

For comparison, I may state that large gas engines in steel mill practice, under best test conditions, show 25 per cent thermal efficiency, but in actual operation, an efficiency higher than 18 to 20 per cent is rare.

High compression oil engines of the Diesel type, driving electric generators, realize 25 to 26 per cent thermal efficiency when new, but are difficult to maintain at such efficiency.

The figures given must not be confused with the much higher thermal efficiencies often quoted for gas and oil engines, which refer to indicated horse power and not to electrical output.

Further Advances Possible in Steam Turbo-electric Unit.

The steam turbo-electric unit has not reached its limit of thermal efficiency. Calculations show that, with pressures of the order of 500 lb. gage, a thermal efficiency of 26 per cent should be easily realized. For any further substantial improvement, we must look to new methods, such as the

*President A, I. E. E. Before Annual Convention.

use of two fluids, for example mercury and steam, as planned by W. L. R. Emmet. This method is still under development but its progress has been hampered by the pressure of war work.

As a matter of interest of electrical engineers, I may say, parenthetically, that the steam turbine in this country owes its existence and development almost entirely to the electrical engineer, and this is not surprising as the electrical engineer was familiar with the advantages of rotary machines, and perhaps it is not too much to say, prejudiced in their favor.

While, as stated, the efficiency of electrical units reached about its limit some years ago, those familiar with electrical engineering development are aware that progress has been made and is still possible in the generation, transmission and utilization of electrical energy. The struggle for improvement in efficiency has been transferred from the unit to the aggregate, called the system. We cannot have a system of maximum efficiency without units of maximum efficiency, but individual units of highest efficiency do not, of themselves, insure that the system upon which they are used will be of the highest efficiency, so progress has been made in the direction of improving the system economy or system efficiency.

To obtain the highest efficiency in practical operation, the element of time enters as a powerful factor. Our conception of efficiency should not be limited to a consideration of the relation between the instantaneous value of available heat units in coal and the electrical units produced at the point or points of consumption, but should consider the relation between the total number of heat units in fuel consumed in a given time, say 24 hours, to the total number of electrical units produced and used in the same time. The attempt to improve the efficiency of the system has shown the necessity for utilizing the generator units and transmission and distributing systems, for the maximum possible time.

Elements in the Efficiency Problem.

This has led to the study of such questions as load factors of generators, of stations, and of the system as a whole, to the study of the diversity factor, to the reduction of idle currents in alternating current systems by the use of synchronous condensers, and to means for the reduction of the constant and no-load losses in all machinery, in transformers, etc.

The resulting improvement has been effected, not only by changes in designs of the units themselves, but also by their method of use, based upon the recognition of the fact that the elimination or reduction of the losses at light load will greatly improve the total efficiency, especially when the time of use of the apparatus under load is a small part of the total time.

Automatic substations for transformers and synchronous converters have come into existence; different power houses of the same system have been tied together electrically; transmission lines of different systems have been interconnected, so that the units may be usefully employed for the maximum period, or lie idle or unloaded for the minimum time.

This general development has led to marked improvement in total energy efficiency, represented by the amount of fuel burned per electrical unit sold or utilized, and has also reduced cost of operation and charges for investment. There is still room for continued improvement in this direction and the progress will be rapid due to the pressure for maximum efficiency in the use of coal and of existing investment at the present time.

Plants Linked Together for Exchange of Power.

Many interesting examples of the methods and devices adopted to improve station and system economy and efficiency may be found throughout the country. In California, large electrical systems have been arranged to be tied together electrically, for exchange of power. In Washington and Idaho, power systems under different management have made similar arrangements. In the South, all important hydro-electric systems have been tied together for exchange of power. The advantage, as I have stated, of such arrangements is better utilization of variable stream flow, improvement in load factor, increased reliability of service, and the net result is to improve the efficiency of the system, not only financially, but in a purely technical sense. One most important advantage is the obvious reduction of the necessary investment in reserve machinery of every description.

In Montana, eight hydro-electric plants successively use the same stream flow, the total effective head amounting to 600 feet, and not only is the natural flow of the stream thus successively utilized, but all the storage water is effectively used by each plant in series. In this same system, the yearly load factor is stated to reach 75 per cent and the monthly load factor to reach 80 per cent.

The interconnection of hydro-electric plants brings about another extremely important saving, based upon the variation of rainfall in amount and time on the different watersheds which are thereby brought to serve a common system. It frequently happens that there will be plenty of precipitation on one watershed, while another watershed may suffer from long continued drought. This condition varies not only in the same year, but in different years. Interconnection serves to eliminate these variations by a process of averaging, and where the inter-connected system covers a sufficiently wide area, a remarkable increase in total useful power is made available.

It has frequently happened that thousands of horse power have been wasted over the dams of one system, the watersheds of whose plants happened to have a wet year, and at the same time, a nearby hydro-electric plant, supplied by another watershed, was without water power. The result has been that one system wasted power, while the other was suffering from a power shortage which would frequently be made up by burning a large amount of high grade coal, in the operation of an auxiliary steam plant. This condition has to a large extent been remedied by the interconnections to which I refer.

Interconnection May Increase Efficiency 25 Per Cent.

It has been estimated, and it seems a conservative estimate, that through the saving in reserve equipment, improvement in load factor, and the diversity of different loads, the useful output of groups of large systems may through interconnection be increased about 25 per cent.

Electric regeneration of power, that is the utilization of the weight of trains running on a down grade due to the force of gravity to generate electricity which is fed back into the electric system to help other trains up grade, is an illustration of the same important improvement in the system efficiency.

I have thought it desirable to call your attention to the improvements obtained in system economy of efficiency because of the important savings in investment, in coal, in transportation, in labor and material, which in the aggregate have already been realized. It illustrates the wonderful flexibility, value and economy of a general system transmitting energy by electricity, compared with any other possible method.

These advances have been more rapid during the last year, due to the imperative demands for economy, saving and increased efficiency imposed by the war. It is a great satisfaction that the foundation had all been well prepared during the times of peace.

The development of our industry has been so rapid that the need of intelligent and constructive standardization was

realized some years ago. The Standards Committee of the Institute, formed in 1898, has been of inestimable value to the profession and to the industry. The standards adopted have been flexible enough to ensure progress and yet to discourage variations which were valueless. The standards promulgated by our committee have so appealed to the profession and to the industry that they have been cheerfully followed, and I am convinced that, as a result, the cost of electrical apparatus to the consumer has been greatly reduced over a number of years and the quality has not been sacrificed, but has been improved. I consider that the money value of the work so done could be conservatively placed at many millions of dollars.

Sixty-cycle systems have shown, during the past few years, a more rapid growth than 25-cycle, and it is now estimated that 60-cycle systems represent about 70 per cent of the total power supplied in the country. This is undoubtedly due to the lowered cost of transformers, generators, induction motors, and similar apparatus. The relative growth of 60-cycle as compared with 25-cycle systems is reflected in steam turbine installations. In 1910 about 60 per cent of the steam turbine energy of the country was supplied from 60-cycle units; in 1917, this had risen to approximately 75 per cent.

This is an instance where standardization is desirable and economical. It will hasten the time so often predicted, when a network of transmission lines, carrying electrical energy, will cover the country. These will be fed by superpower stations, suitably located with respect to cheap reliable supplies of coal for fuel, and water for condensing purposes and into the same network will also be fed energy from the various hydroelectric installations.

Electric Furnace Comes to the Front.

Marked advances have been made during the past year in the application of electricity to the electric furnace. It is estimated that the number of electric furnaces in the United States has been increased about 40 per cent in the past year and that there are now in operation over five times the number that existed five years ago. The world's output of steel from electric furnaces has grown to approximately four million tons per annum.

Experience has demonstrated that the electric furnaces can utilize the cheapest and most inferior raw material to produce steel of the most uniform and highest quality, with the greatest regularity. The cost of steel so produced, while reasonable, considering its quality, was higher, until recently, than that produced by the open-hearth method. It is now possible to produce electric steel at substantially the cost of that produced by the open-hearth method. This result has been brought about partly by the increased cost of the open-hearth method, due to a variety of well known causes, but largely by a reduction in the cost of electric furnace operation. The marked change which has taken place in the reduction of the cost of operating electric furnaces is based upon greatly increasing the rate at which energy is delivered to the metal, both during the melting and the refining period. This has reduced the time required for an individual heat and also the kilowatt hours required per ton of metal melted, with a net result of increasing the daily output of the furnace.

As a concrete example, I mention the history of a five-ton furnace. It was originally supplied with 800 Kv-a. at 80 volts. This was increased to 2000 kv-a. at 150 volts for the melting period and about 1400 kv-a. at 100 volts for the refining period. The time for the heat was reduced from six to three hours, power consumption was reduced from 877 kw-hr. to 588 kw-hr. per ton, and the number of heats per 24 hours was increased from three to five, increasing the net output from 15 to 25 tons.

Electric resistance furnaces of large sizes, for special heat treatment requiring unusual exactness, are being extensively used, producing results greatly superior to oil or gas fire furnaces.

Electric welding, both by the arc and incandescent method, is being rapidly extended and is destined to greater development in ship-building and similar operations.

The Electrical Engineer's War Activities

Electric engineers have been devoting much time to the solution of many war problems. It is not desirable or possible to review such work at present, but when the veil is lifted, we will all be gratified with the result. We must content ourselves with the mere statement that this work has covered means for the detection of the pirate submarine; wireless signalling and telephoning for army and navy, and aircraft devices; searchlights of novel design and great power; improved methods in manufacture of ammunition and ordnance; electro-chemical work of every description; electric welding; X-ray sets of greater simplicity and accuracy and many other lines too numerous even to mention.

The great industrial research laboratories, the educational and governmental research departments have all cooperated enthusiastically and effectively, and the members of their staffs have labored day and night, without regard to pecuniary reward or public applause, sustained entirely by the high purpose of giving their best to the service of the country. I hope the time may come when the story may be told, so that the world may realize the debt which it owes to scientific men and engineers, without whose arduous, unselfish and almost inspired work, our cause, righteous as it is, would have no chance of a victorious conclusion.

In my address at the opening of the mid-winter convention of the Institute, in February, 1918, I called attention to the advantages which it seemed to me would follow a more general electrification of the steam railroads of the country. I merely repeat at the present time that electric locomotives have been so improved and simplified that they are competent to haul the heaviest train that can be held together with the present train construction; to operate at the highest speed permissible by the alignment of the road and independent of its grades; and that the electric locomotives can meet in the most efficient and adequate manner the transportation problems confronting the country, and offer better results than are now obtained or seem possible with steam locomotives.

Electrification Would Help the Transportation Situation

There can be no question that railroad electrification is not only economical but imperatively needed to improve the present standards of steam operation. Our mountain districts are congested almost entirely by the limitations of the steam railroad systems, and the addition of more tracks, under such conditions, is not the best solution of the problem. The electrified divisions of the steam roads have been free from troubles during the past severe winter and I repeat that the coal famine which the country suffered last winter could have been largely avoided if the steam railroads had been electrified. Moreover, it should not be forgotten that steam locomotives burn about 25 per cent of the entire coal mined in the United States and that 12 per cent. of the entire ton mileage movement of freight and passengers carried over our railroad tracks is represented in cars and tenders required to haul coal to supply steam for the locomotives.

It is a truism, which has been frequently stated, that war requires the mobilization of the nation's industries and their devotion to essential work. This is especially true in this country, as it has been necessary in addition to create substantially new industries on an enormous scale, such as the production of ships, ordnance, ammunition, airplanes,

chemicals etc. To operate these industries, it has been necessary to mobilize to the fullest extent our available material and labor, but material and labor can only be converted into war work by the application of power. This power, in view of its great economy and flexibility, must be electrical.

While this country was fortunate in having available a magnificent system of power stations, so great was the magnitude of the demand for increased power, created by the war industries, that it is estimated that there will be a shortage of at least 500,000 kw. of electric power in the Eastern district.

It takes from one to two years to build and equip the large units which are essential for the production of such power. This illustrates the importance of all of the methods which I have mentioned to conserve, utilize and increase the efficiency of existing equipment and investment, as such methods can produce results in a much shorter time.

It is, however, vitally important that the great electrical power producing companies of this country should be helped in every way to meet the heavy demand which is placed upon them. It has been demonstrated that the quickest, most efficient, and altogether best way to meet the demand for power is through the expansion of such existing organizations and installations.

Fortunately, there is general appreciation of the fact and comprehensive schemes are under consideration which will provide for the erection of large steam electric power stations in the mining regions. Favorable locations exist which are within reach by transmission lines of electric power stations now serving large industrial areas. By interconnection, present investment and machinery will be better utilized and a large amount of additional electric power made available, without making any increased demand upon our congested railroad facilities.

It is evident, therefore, that we need to consider and put into effect, every practical method for conserving our existing developments, and also, we should take a courageous view of the future; we should provide, for the future growth at least as liberally as has been the custom of the managers of the great public service systems in the past. It has been their custom to build from two to three years in advance of existing requirements, in anticipation of the future. I have yet to learn of a single important instance where such foresight has not been amply justified.

I would say in conclusion that the saving in fuel, by such improvements as I have mentioned in various parts of my address, amounts to many millions of tons every year; the saving in material and investment represents millions of dollars, which manifestly represent service of the highest value to the industry and to the country. Such work is just as much the province of the electrical engineer as improvements in the design and efficiency of the electrical units, and requires the same scientific ability, vision and industry.

While I admit to considerable prejudice in favor of things electrical, I think that in no other field of engineering has there been such a remarkable improvement and a condition which so nearly approaches, in the matter of efficiency, to 100 per cent, as has been shown in the field of electricity. This phenomenal record is not the result of accident. It has been due to the enthusiastic devotion of the scientist and engineer and executives to their work. They have not been satisfied with things as they are, or with mediocrity. They have wanted the best; have not been contented with a 75 per cent. to 80 per cent. efficiency when something better was obtainable. The causes of inefficiency have been scientifically attacked; the loses have been studied and their causes discovered and removed.

Handsome Montreal Showrooms.

The cut herewith shows the interior of the new sales and show room of the Montreal Light, Heat & Power Consolidated, at the corner of Mountain and St. Catherine Street, Montreal. The lower floor is utilized for the display of various electrical and gas fixtures and appliances, and as the cut indicates these are effectively arranged. The whole interior is very attractive. At the rear are the cashier's desks, and next to these is the rest room, furnished with Persian rugs and easy chairs. The windows are also utilized for the showing of appliances. A large electric sign is erected over the entrance on St. Catherine Street.



Interior of new show and sales room of Montreal L. H. & P. Co.

Engineers and the European War

By Major General William M. Black*

It is an honor to be privileged to address you on a subject of such importance to our country, the duty of the Engineers in war. Although the part played by Engineers in this war is great and the responsibilities of the profession are correspondingly large, this war, like all wars in the past, is and must be a war carried on in accordance with the principles of the art of war, which are unchanging and which have been recognized and taught ever since organized armies were first created.

Do you realize that almost the only absolutely modern method of warfare now in use is the warfare of the air? The invention of submarines was made during the American Revolution, and submarines were used successfully, though to a limited extent, in our own Civil War. Gas and flame fighting are of ancient origin. Trench fighting is hardly better known to-day than it was to the veterans of Grant and Lee, of Sherman and Johnson.

Engineer Must Add to His Peace Equipment.

The advances in human knowledge have caused corresponding improvements to be possible in the weapons of warfare. Increased knowledge of chemistry has produced more powerful explosives and improved methods in metallurgy have enabled these explosives to be utilized, by making possible heavier and more powerful guns. Improvements in the means of transportation have enabled larger bodies to be moved more quickly and more readily and to be subsisted and supplied with greater certainty. The telegraph, the telephone and the wireless have afforded a means of prompt communication and have enabled larger bodies of men to be given coordinated action. With such changes, battles are fought on the same principles and won or lost from the same causes as in the time of Alexander the Great. This war has been called a people's war and so it is in the sense that due to modern facilities the entire resources of the people can be utilized to-day as they could not have been utilized in the days of old. It has also been called an Engineer's war because in the quickness of movement and in the works necessitated by these modern inventions the services of Engineers become more conspicuous and perhaps more necessary than in the past. But engineering in warfare has always been essential and it is even doubtful whether the science of engineering does not owe its birth to the works of war. An Engineer myself, I would be the last to belittle the work of our profession. It is a matter of pride that the men of our profession, due to the nature of their employment in time of peace, are, of all the civil professions, most prepared to serve the country in war, but to serve the country adequately in war, the Engineer must add to his peace equipment for professional work. The profession of arms is a profession in itself and it is the profession which deals with the very greatest in magnitude of all the endeavors of men. The effective use of an army which is properly constituted exemplifies the best that men can do in organization, in discipline and in the devotion to duty which causes a man to regard his own life as a thing of small moment toward the attainment of the end sought.

Deluge of Suggestions.

There would be a great amount of effort saved if our people recognized more clearly the existence of the technicalities of the profession of arms. The government is simply deluged with suggestions and so-called inventions for the winning of the war. The records show that about 98 per cent of all of these are without military value and that time and labor have been thrown away by men eager to help, but entirely ignorant of the history and conditions of warfare.

An example with which some of you are familiar is the electrical gun. For years the possibility of such a weapon has been a fascinating line of study to electricians. The principle of the solenoid is the germ. If a series of solenoid coils were to be energized and de-energized in succession sufficiently and rapidly, such a series around a tube can be made to impart a movement of translation and rotation to a projectile. But practical results are to-day impossible. A six-inch service rifle having a length of 20 feet, fires a projectile weighing 110 lbs. with a muzzle velocity of 2,600 ft. per sec., or in other words, the projectile leaves the muzzle with a kinetic energy of translation of 115,500 ft-lb. This energy has been stored in the projectile during its travel through the bore of the rifle, or say in 1/65th of a second. The average power expended has therefore been at the rate of 7,607,500 ft-lb. per second or about 14,000 h.p. or 10,500 kilowatts. These figures are simply approximations and neglect entirely the power required for imparting velocity of rotation and for overcoming the friction in the bore. You can easily estimate the weight and dimension of the generating equipment which would be required for even a moderately powerful gun were all the mechanical and electrical problems of its manufacture solved, and making due allowance for the short-load periods. You can understand the impracticability of transporting the electrical plants required for any number of such guns, and the impossibility of distributing this power over shell-swept ground to guns whose position must be constantly shifted, and which must be put in action on a few seconds' notice. I think that you will agree that until new discoveries give a much improved method of storing or generating electricity, smokeless powder will continue to be the most compact and convenient form of stored energy for guns.

And yet there has been a good deal of time and money wasted in trying to perfect such a gun by men whose patriotism is undoubted, and whose ignorance, also, is undoubted. In other words, if a man has an invention or an idea of an invention, by all means let him work on it, but before he goes to Washington and takes up the time of men busy trying to devise means to beat the Boches, let him make sure that he knows the conditions of war and what he is trying to do to meet those conditions, and then if he is sure of the means, let him present his ideas and inventions to the proper authorities.

We want all we can get and want the best we can get. We want the inventive power of our coutry if it can be exercised to do good.

Inventors' Home Proposed.

There was a proposition made seriously at Washington recently that the United States should provide a fund, of I do not know how many million dollars, and make a Home for Inventors, where any one who thought he had an invention would be able to go, and work it out at the public expense; and recently, although we had a committee of experts there to pass upon these inventions, the results were so utterly unsatisfactory to the inventors that they came in a perfect horde upon the secretary of the navy and the secretary of war, so much so that they had to make a brand new committee of three men, who could be much better occupied

* Chief Engineer, U. S. Army, before A. I. E. E. Convention.

to go ahead and do this same thing, and I am only waiting for the next wave of inventors to show that this committee can suit them one particle better than the old one did.

In addition, without doubt, there are many men in our country of the highest patriotism who are sore-hearted because they are not given something to do directly toward the winning of the war. They do not understand, that some condition peculiar to themselves, possibly age, possibly physical condition, possibly mere ignorance of war and its conditions, compel it that the bit that they must do for their country at this time is to continue in their work in civil life and do their part in keeping up the normal life of the country—in itself a service of importance.

The part which engineers are now playing in the war is a very great one. The records of the American Institute of Electrical Engineers show that out of a total membership of 9443, there are 973 in the service, or 10.3 per cent of its roster. The American Society of Civil Engineers with 8,753 active members, has 14 1-3 per cent in the service. The American Institute of Mining Engineers 10.4 per cent, and the American Society of Mechanical Engineers 10.1 per cent. But these records are not complete. At the outbreak of the present war there were in the Engineers Corps of the Regular Army about 300 officers and approximately 3,500 enlisted men. At the present time there are about 8,000 commissioned officers and 200,000 enlisted men men, made up of men formerly engaged in works of an engineering character. It is probable that this does not represent much more than one-half of the number of the profession now serving in the army.

Engineer Works in the Van and the Rear.

Let us consider the nature of the work of the Engineer, passing from front to rear of the army.

First in importance is the work of the sappers. They go before and remove obstacles, clearing away obstructions, building bridges and roads, making the trench systems complete, mining, providing light, water, lines for supply (light railways or roads) and military mapping. In this category enter practically all of the branches of the profession. Further to the rear are found the construction and operation of railways; road and bridge construction; the construction of veritable towns for supply depots, with all their accessories, drainage, sewerage, lighting and water supply; construction of quarters and of hospitals; and furthest to the rear, the construction of the ports of debarkation with their wharves, storehouses, railway lines, yards and shops, all with their sanitary systems. Separate from these activities, but necessary for their supply, are the Forestry troops who turn the growing timber into lumber of the dimensions required for the various services. Locomotive and car shop troops are performing essential services. Topographic Corps, Sound Ranging Corps and Camouflage Corps are also among the varied activities of the engineers.

What preparation is required for the fulfillment of these varied duties? For the actual technical work of construction or installation the civil training of the engineer should prove sufficient when the plans which embody the military features have been prepared, or when the military technique has been learned and assimilated. A fundamental of this military technique is that the time element is to be considered rather than money cost and that the work must be done with whatever materials are available. This requires clearness of conception of the results required, resourcefulness and organization —factors also required for civil work.

As stated earlier, due to the very small numbers of the personnel of the corps of engineers of the regular army, reliance had to be placed in the members of the profession in civil life. Confidence in their devotion to country and in their ability has not been misplaced. The results already accomplished prove this fully. Could more have been done? Undoubtedly, had the profession been better prepared for the call.

Sound General Education Requisite to an Engineer.

Will you permit me to say a few words concerning the general training of our engineers, based on a professional experience of more than forty years? The conviction has been forced upon me that in educational matters, as in many other affairs of life, we Americans are inclined to go too fast. The basis for any professional career where the highest is to be attained must be a sound general education. Does anyone of you regret the lessons gained in your own experience? Is not the experience of humanity as shown in properly written history of almost equal value? Would Russia now be in the sad condition existing had her people known that the experiments she is trying have always resulted disastrously? Yet is history thus considered in an ordinary technical course? Again, do you not find a knowledge of the general principles of law and of the special rules of the laws of contracts of value? Are these considered essentials? What is the handicap of an engineer who is unable to express his ideas clearly in spoken and written English? Is this taught thoroughly in our technical courses?

It goes without saying, that the study of pure and applied mathematics is found in all technical courses. But, are these subjects well grasped before their application in special technical courses is studied? Is any faculty of an Engineer of greater value than the ability to form a mental picture of his problems and of their solution? Yet is that study which assists most in this faculty—descriptive geometry—properly apprehended? Is there any branch of the profession which in its application is not based on a knowledge of topographical work, on a knowledge of construction materials and of how these should be used? Is the study of these branches of civil engineering insisted upon sufficiently in the mechanical and electrical courses? In effect would not our professional men be better equipped for their civil work were they not in too great a hurry in their youth to enter directly into life's combat? Does not this war teach that without a long and elaborate preparation down to the last details, an attempted "drive" must fail?

These remarks apply to all engineers, both military and civil. In the rush of war men cannot always be hand-picked for special jobs and frequently it becomes necessary for an available man to be used for the work immediately necessary, irrespective of his previous training. In this supreme test of humanity the best man is he who is prepared to meet any emergency—perhaps not in the most finished way—but to meet it.

There are things that the engineers in this country can do. If they do know enough to give us some ideas for helping along in the killing of Boches, for God's sake let us have them. If they do not, what they can do is to help the supply of men for the winning of the war. We are now short of officers of engineers, very short, and we are going to be very much shorter. We must have educated engineers for this work, and we must not only have the men for the line of work of the army, but we must have mechanicians and artisans and laborers for the special work.

All of you men have spheres of influence—do your best in them, and if you can be used otherwise, and the problem comes up in which we need you, you may be sure you will be called upon. There is is problem now, the supply of men, in which you can help, either by your own personal sacrifice, in going out, or by influencing others.

Now as to soldier work. The movements of drill and the construction methods peculiarly military are easily learn-

ed. The knowledge of the art of war which will enable these to be applied promptly and properly is more difficult. But most difficult to acquire is the peculiar mental discipline which makes the soldier. The Army is a huge machine which must work co-ordinately in all of its parts. That competition, which in civil life causes one body to advance further and faster than another, is out of place in an army. All must work together and for one common end. Each man must so subordinate his will and desire to the common good as to work willingly and earnestly in the sphere allotted to him. This does not mean that all initiative is to be suppressed. On the contrary each man must use his initiative to the utmost, but in his own allotted sphere of action. Each must learn to obey and obey from the heart. Through such obedience comes the knowledge of how to command when command becomes a duty. All of this is hard to learn. But each man who is called upon to help in this war must learn it, if he would help effectively.

By all means let us have military training in our schools, but let it be true military training and not tin soldier work.

There is another line of technical military knowledge which must also be studied hard. The machinery for the organization, training, supply and leadership of troops; the methods of obtaining, accounting for and issuing supplies; of keeping returns of the men; and the channels of command must be studied. To civilians in general this is wholly unknown, but if a man is to be of service in the army, it must be learned until its use becomes automatic.

Sound Ranging

I wish I could go into greater detail as to the work of these sound ranging corps, because it comprises some new electrical work of the highest character, and the apparatus for it has been perfected in this country. We took the best devised at the beginning of the war, and our physicists went to work and have made marked improvements. Perhaps you do not know what sound ranging is. The artillery is stationed in the rear of the line. There is almost no direct artillery fire any longer—that is, as a rule, the gun is fired from a point where the target cannot be seen at all. The first thing to be destroyed, invariably, is the enemy's artillery, then the trenches are attacked. The obstructions of wire are torn to pieces, the trenches themselves are practically leveled, and after that is done, in the assault, there is what is termed the barrage fire. That, I suppose you know, means a fixed or slowly moving curtain of shells dropped on a certain given line and through which passage is almost impracticable.

On both sides the artillery is carefully camouflaged so it cannot be seen from aeroplanes. To show what care is taken, even the tracks that are made in taking the guns to the front are wiped out, the guns themselves are covered, so that neither from an observation balloon nor an airplane from the enemy's line can the position of the gun be seen, and in order that the flashes of the gun cannot be located, there are dummy guns placed at intervals, and flashes from these guns made by electricity, so that the position of the real guns cannot be known.

In order to determine the position of the real guns, there are delicate instruments which have been devised, which are placed at intervals along the line. These instruments are for the purpose of registering the sound of the gun. There is, first of all, the sound of the gun in firing. That is preceded frequently, if the range be great, by the sound of the shell passing through the air, and sometimes by the bursting of the shell itself, before the sound of the gun comes. These are all recorded, and the velocity and the direction of the sound is known. By having these instruments at different points on the line, the position of any one gun can be "spotted," and "spotted" so closely that our own artillery fire can be directed and the gun blotted out. That is one of the improvements of modern warfare rendered possible by the advance in general human knowledge, particularly in electrical knowledge, and these instruments are very exact.

This service of the rear is of great importance and magnitude. Picture to yourselves what is required to transport, house, supply and maintain a million men three thousand miles from home, producing nothing and in their work expending enormous amounts of materials.

Establishing and Maintaining the Army.

Taking the question of storage alone, the provision of space required for an army of $1,000,000 for ninety days aggregates 20,000,000 square feet of floor space of covered storage and double that amount of uncovered storage space, with the necessary railway tracks for receipt and shipment and for classification yards, aggregating about 650 miles. Add to this an equal mileage of highways, adequate provision for water supply, sewerage and electric lighting and power and you can realize the work involved in this one item. Add to this the constructions which have been built at the ports of debarkation (at one of whch 375,000 square feet of wharf space had to be provided), the hospitals, barracks, shops, and the lighting, water and sewerage systems required, and some conception of the actual new construction work done, can be formed.

It is estimated that the supply of the army requires the transportation to the front of 25 lb. per man per day. This makes heavy demands on the French railway systems, good as they are. These have had to be supplemented in all but the main line trackage, and a large amount of motive power and of rolling stock has had to be supplied and operated.

Among the special services, the work of the geologists must be mentioned, and in the line of improved apparatus, it may be stated that new instruments and methods for airplane photography have been devised and introduced. Other new auxiliary aids for fighting have been worked out, some of which have already proved their value on the battlefield.

Yes, the engineers are doing their work well. Be it in constructions in the rear, or under fire, be it in the transportation of ammunition to the firing line, the construction of strong points and obstacles, the construction and destruction of bridges in the face of an enemy, or as in recent instances, under the feet of the enemy, or be it with their rifles in beating back an attack, they are doing and dying. All glory to our comrades in arms in France! There is not a red-blooded American who does not envy them.

Electrical Trade After the War

Recently the British Board of Trade appointed a Departmental Committee on Electrical Trades to consider the position of the British electrical trades after the war, with special relation to international competition, and to report what measures are necessary or desirable in order to safeguard that position. The report of this committee has just been made public. The report points out that the value to Great Britain of the electrical manufacturing trade already amounts to 22½ millions, sterling, a year, but that this figure only represents a fraction of the trade that can be obtained if the blunders of the past are rectified. The war has demonstrated that the safety of the Empire is dependent on the employment of electricity. The prosperity of the industries depends largely on cheap energy for driving machinery. The applications of electricity to agricultural purposes is also commanding attention. The scientific replanning of the distribution of energy would effect a saving of 50,000,000 tons of coal per year, which would at the same time reduce the

cost of power for manufacturing, lighting of streets and buildings, propulsion of railway, tramway and road vehicles. The report is summarized in the following recommendations:

(1) A thorough reform of the legislation and conditions under which the generation and distribution of electricity are promoted and administered in this country which will involve modifications in the relevant Acts and Regulations, and a like reform of the legislation and conditions affecting the promotion, construction, and operation of tramways and light railways.

(2) The prohibition of import of enemy goods for a period of three years after the conclusion of peace, subject to importation under license in special circumstances after the expiration of the first twelve months.

(3) The imposition of import duties sufficiently high to protect effectively the electrical industry.

(4) The prevention of the sale in the United Kingdom of any imported electrical goods at prices lower than those current in the country of origin.

(5) The recognition of the advantage of combination among manufactures and official co-operation with such action.

(6) The prevention of any concern engaged in the electrical or allied manufacturing industries, if controlled directly or indirectly by enemy capital, from continuing to trade within the Empire, unless it be specially authorized and its constitution made public, and the passing of legislation requiring that not more than 25 per centum of the capital in any other electrical or allied undertaking shall be held either directly or indirectly by enemy subscribers or their agents.

(7) The treatment as enemy products of all goods produced in foreign countries by concerns controlled by enemy capital or under enemy direction.

(8) The exclusive acceptance of British tenders by State Departments, public bodies and companies supplying electrical energy under statutory powers.

(9) The adoption by Government departments and public authorities, so far as is practicable, of standard types and patterns of plant and apparatus.

(10) The prohibition of transport discrimination operating to the detriment of British manufacturers, and the provision of improved transport and cargo handling facilities.

(11) The promotion of a better understanding between employers and employed and the provision of better housing and working conditions.

(12) The provision of extended banking facilities, preferably by the establishment of industrial banks, to enable British manufacturers to secure and finance contracts and engineering enterprises.

(13) The recognition of the permanent and ever-increasing importance to the Empire of the natural sources of power for the generation of electricity in the British Dominions, and the introduction of safeguards by legislation or otherwise to prevent these national assets from passing into alien hands or under alien control.

Electrical Industrial Trucks and Tractors*

There is no longer an question of the utility of electric storage battery industrial trucks and tractors. In fact, the success of these small members of the electric vehicle family has been so pronounced that it is now a manufacturing rather than a sales problem,—the demand being greater than the supply, although manufacturing facilities have been increased not only by extension to plants, but by several new manufacturers entering this virtually unlimited field.

Nor is this development of a temporary, mushroom growth associated with efforts being made to expedite war measures, although the necessities of war have emphasized the value of these modes of interior and exterior transportation as encountered in industrial establishments, factories, at railroad and steamship freight terminals, warehouses, etc. And these units are playing a major part in the manufacture and transportation of vital munitions, both in this country and allied countries abroad.

Later, when we can speak more specifically of war operations, the intimate story of what electric trucks and tractors have contributed to our success will make very instructing and fascinating reading. In the meantime it is sufficient to know that they are discharging very important assignments most creditably.

The economic advantages of the electric truck and tractor are so great that actual results ofttimes seem to parallel the fantastic and absurd claims of some "get-rich-quick" stock selling schemes calculated to separate persons from perfectly good coin of the realm. Therefore, justifiable claims have been considerably modified and reduced so that prospective users would not suspect that they were being asked to buy gilded gold bricks. Even when such large "factors of safety" have been applied, the very modest claims advanced sometimes apepar to the uninitiated to be extravagant. However, results in practice are so much greater than what might have been anticipated that such users promptly become effective exponents of such means of transportation, their enthusiasm being rapidly transmitted to others in need of such transportation service. If ever the phrase "advertised by our loving friends" applies, it is in order with electric industrial trucks and tractors, for users are proving to be the most valuable sort of a sales organization, even although they are not on pay-rolls of the manufacturers.

A story is told how a railroad in the West arranged for a demonstration of electric industrial trucks with six separate manufacturers, each of whom placed on trial for ninety days, without charge, one unit. At the end of ninety days the railroad purchased six trucks out of the savings effected during the free trial period. This comes pretty near being "something for nothing." It is needless to state that such free trial practice has been discarded just as same has been exterminated in other branches of the automobile industry, where, in the early days of the development, such generosity was grossly abused. However, this example illustrates effectively the economic advantages of such modern transportation.

The Crouse-Hinds Co. of Canada are distributing a folder on marine condulets, which are made in special water-proof types and meet every marine requirement—from ordinary elbows to junction boxes, lamp outlets and high capacity plugs and receptacles. The same company have issued catalogue No. 1000 H, describing the ZY series of Saftey First Motor Switch Condulets—"The last word in small motor switches"; well illustrated.

Trade Publication

A very attractive treatise has been prepared by the British Aluminum Co., Ltd., 60 Front St. West, Toronto, and is being distributed with the compliments of Mr. E. V. Pannell, local manager. The booklet is entitled "From the Falls to the Factory—A Treatise on Electric Power Transmission." It is divided into eight sections, dealing respectively with: Transmission Line Design; Conductance and Tenacity of Aluminum; Tension and Sag Problems; Spans and Supports; Aluminum Steel Cables; Construction and Costs; Modern Transmission Lines; Tables and Data. The booklet is very well illustrated with photographs and line drawings, and contains a quantity of very timely information assembled in the smallest possible space.

* By A. Jackson Marshall, secretary Electric Vehicle Section, N. E. L. A.

The Dealer and Contractor

Strong Toronto Delegation at Annual Convention of National Electrical Contractors and Dealers—Discuss Wider Canadian Organization and Affiliation — Mr. Goodwin Coming to Toronto

The 18th annual convention of the National Association of Electrical Contractors and Dealers took place at the Hollenden Hotel, Cleveland, Wednesday, July 17, with a strong Toronto delegation in attendance. Messrs. L. O. Horner, W. F. Dean, of the Canadian General Electric Company, F. P. Davis, of the Northern Electric Company and F. J. Allen, of the Benjamin Electric Manufacturing Company of Canada and the following members of the Toronto Electrical Contractors' Association: Messrs. J. Everard Myers, treasurer; Harry Hicks, vice-president; E. C. Clarke, E. A. Drury and Kenneth A. McIntyre, president.

For a considerable legth of time the Goodwin plan and the re-organization of the National Association have attracted the attention of the electrical fraternity. The Toronto association has been in correspondence with the British Columbia Association of Electrical Contractors and Dealers, having in mind the possible Canadian affiliation with the National Association of the United States, involving, of course, an adaptation of the Goodwin plan to Canadian conditions.

With the primary object in view of learning more of the Goodwin plan and hearing of it from Mr. Goodwin himself, and also of discussing with officials of the National Association details of the projected Canadian affiliation, the above mentioned delegation visited Cleveland. In retrospect it is rather difficult to give an accurate report of the proceedings—there was so much of interest and of benefit to all, together with unbounded enthusiasm.

At the very outset of things it was announced that Mr. W. G. Rose, president of the Cleveland Advertisers' Club, was on hand for the express purpose of pumping enthusiasm into the delegates. This purpose was accomplished so successfully that its effect was evident throughout the entire proceedings.

The papers read at this convention were unique in their real worth and in the valuable information made available to the average contractor-dealer. These papers will be reviewed in later issues. Most of one session was taken up by a round-table conference on labor-cost data. The material for this was largely prepared by the Electrical Estimators' Association of Chicago. Estimates of typical classes of construction were followed through from beginning to end and several systems of checking results were explained. All of this data is to be issued by the National Association in data sheet form for the benefit of the members of the Association. This information was prepared at a great deal of trouble and expense for the entire electrical contracting industry which is thereby greatly indebted to the people who made it available.

Thursday morning Mr. James R. Strong, of New York, gave his very lucid explanation of the organization plan of the National Association. Then came Mr. Goodwin, who unfortunately had suffered a broken ankle as the result of an accident. This hampered his movements somewhat but did not detract from the forcefulness of his explanation of the Goodwin plan.

Following the morning session the delegates, through the kindness of the Cleveland Contractors' Association, were conveyed to Nela Park, where they were entertained at luncheon by the Nela Park officials. Nela Park is a delightful spot and every consideration seems to have been shown to make it an ideal place for the employees. Following the luncheon the afternoon session was held at the Grove at Nela Yark, a sylvan setting with rustic benches and platform. At this session the electrical contractors' duties to the Nation were explained by Sullivan D. Jones, Washington representative of the Association. Mr. Jones devotes his entire time to representing the contracting industry in Washington and, consequently, is in very close touch with such affairs. Mr. Dwight D. Miller, of the Society for Electrical Development, gave a very complete paper on the Application of Electricity as Applied to Industrial Plants. Toward the end of Mr. Miller's paper all the whistles in Cleveland seemed to break forth at once and with such volume of sound that it was quite impossible for the speaker to be heard. It turned out that the excitement was created by the news of the beginning of the allied drive in France. Receiving this explanation the meeting broke up enthusiastically and paraded from one end of the grounds to the other, assembling finally in the main square to hear impromptu speeches. This celebration deservedly gave opportunity for the delegates to vent their enthusiasm.

That evening the Canadian delegates gave a dinner to Mr. Goodwin, Mr. Peet the National chairman, Mr. Strong chairman of the National Constitutional Committee and Mr. Arnold, chairman of the National Membership Committee. At this dinner they discussed ways and means of Canadian affiliation. The following morning the National Association, on the recommendation of their Resolutions Committee, unanimously adopted amendments providing for a fourth, and Canadian, division. This Canadian division will be a unit and at the same time an integral part of the National Association.

Mr. McIntyre sent a telegram to Mr. Williams, president of the Vancouver Association, informing him of this arrangement, which was really Mr. Williams' idea. Later in the day a telegram was received from Mr. Williams saying that the British Columbia executive had approved and would recommend national affiliation at their annual meeting in September. This was very good news indeed and indicates that the Canadian electrical contractors are not too slow to take advantage of the opportunity presented in this larger field of usefulness.

Two evenings were given over to social entertainment

The Twenty-One Planks in the Goodwin Platform

The Goodwin Plan Advocates:

1.—A strong and representative association of electrical contractor-dealers (retailers) and urges all interests to lend immediate assistance to this end.

2.—That each division of the industry prepare a code of ethics outlining its own functions, relations and responsibilities to each of the other divisions of the industry.

3.—That each division establish a code of practice outlining its methods, policies, etc., in dealing with other than divisions within the industry.

4.—Improvements in merchandising methods, better display, and the encouragement of more retailers, by urging present contractors to open retail stores, thereby enlisting the support of central stations and offering a broader and larger outlet for manufacturers.

5.—Recognition of the service functions of the contractor-dealer and recommends a differential when this service is performed.

6.—The sale of high-grade electrical material; the establishment of high-class specialty retail shops; improved specifications in wiring installations; and the introduction of liberal use of convenience receptacles.

7.—Broader education of the public concerning the problems of the electrical industry, and concerning electricity, its use, and the application of household devices.

8.—Retailers applying intensive sales methods in connection with small devices used in home, factory, office, etc. (such as washing machines, vacuum cleaners, dishwashers, electric ranges, electric heaters, household heating devices, sewing machine motors, fans, lamps, portables, fixtures, vibrators, hair dryers, ice machines, etc.).

9.—The introduction and application of proper cost-accounting methods in wholesale and retail merchandising, particularly if either function is a minor department of a company.

10.—Free and unobstructed flow of trade along most economic channels, without attempt to direct it through fixed channels.

11.—That central stations conduct retail departments for the sale of lamps, appliances, devices, portables, etc., and operate same in accordance with the ethics of retailing and with full regard to proper cost accounting.

12.—That all interests conduct retail departments, to be operated at a profit. The adoption of this policy on part of central stations and jobbers will result in a large number of concerns entering the retail field.

13.—Recognition of the service function of jobbers in the distribution of supplies and recommends a differential when full service is performed, and a proportionate differential when only a partial service is rendered.

14.—Jobbers determining, through proper sost accounting, the cost of warehousing, and selling their principal commodities, to the end that each principal commodity will carry its proper portion of overhead.

15.—Open meetings of all trade associations, including meetings of executive committees.

16.—That the electrical press become an integral part of each division by honorary or associate membership, and that unrestricted publicity be given the proceedings of all meetings.

17.—The formation of a national lecture bureau, with state and local staffs. The function of the staff would be to carry on educational work within the industry and before public gatherings. Service to be gratuitous.

18.—Recognition of the principle that any action taken by a single division which affects another division is seldom satisfactory unless each division affected is represented.

19.—The appointment of committees by the National Electric Light Association, Electric Supply Jobbers' Association, National Association of Electrical Contractors and Dealers, and various manufacturers' associations to meet together to study the problems of the industry and to cooperate in finding their solution.

20.—Consolidating or reconstructing overlapping organizations. A committee comprising representatives from each association should be formed to study this question and submit a plan.

21.—Eventually a single organization in the electrical industry, consisting of national, division, state and local sections; also main national sections for the solution only of functional problems of the several branches or groups.

and the banquet on Friday was notable for its friendly spirit and the sentiments expressed by everybody present.

The Toronto delegtation are unanimous in their thanks to the officials of the National Association and the Cleveland Association for the warmth of their reception and the many courtesies shown during their stay. They will not soon forget the Cleveland annual convention of 1918.

The National executive committee have accepted our invitation to hold their quarterly meeting in Toronto, October 14-15-16. We are doing our best to arrange to have Mr. Goodwin present. The big event will be a banquet Monday evening, October 14, to which is cordially invited representatives from all branches of the electrical industry to hear a paper on the Goodwin plan and to see it started in Canada.

The manufacturers and jobbers are willingly co-operating in this campaign to reach the electrical contractors and dealers in all parts of the province of Ontario. During September it is expected that the Ontario Association of Electrical Contractors and Dealers will be formed and the contractor-dealers on October 14-15 will be given an opportunity to taking their place in the Canadian movement.

The Goodwin plan has been printed and re-printed time and again, but some way or other there is considerable misapprehension on the part of many electrical men as to just what the actual interpretation of his plan may be. Perhaps the whole situation is best explained by saying that Mr. Goodwin simply advocates the exercise of common sense in the solution of the electrical problem. Indeed, after reading his platform one cannot resist the temptation to say, "Why, of course, that is the natural thing and just what I have always advocated." Mr. Goodwin does not raise any contentious points, does not ask any one element in the industry to sacrifice anything to any other element. His plan means a common benefit to all interests concerned.

In reading Mr. Goodwin's platform, therefore, do not look for anything difficult to understand. Do not try to read anything in between the lines. His scheme is as simple as it looks, and it looks as if it would work out very simply. Electrical Merchandizing in its latest issue has taken the trouble to pick out the salient features of Mr. Goodwin's platform, submit them to him for approval and publish them in such definite shape that we feel we cannot do better than reproduce them word for word for the benefit of our readers. The arrangement of twenty-one planks printed herewith is taken from that magazine:

The Goodwin Plan

A campaign of education conducted principally through trade papers, trade organizations and other channels, to coordinate the various interests in the electrical industry and to bring them together in harmonious action, so that there may be established retail distribution of electrical materials at fair prices to the consumer, and at a fair profit to all parties taking part in the transaction. The basis of the plan is:

First: that each individual owes a responsibility to the organization representing his branch of the industry.

Second: That the organization owes a similar responsibility to its members.

Third: That each organization representing each branch of the industry owes a responsibility to all other organizations in the industry, all to the end that all problems may be discussed, having in view the interests of all, thereby providing a basic plan for more adequately and efficiently serving the general public, resulting in an extension of the activities of our industry to the great undeveloped field before us.

Objects of the Plan

Intensify development in present fields.

Extend the industry to undeveloped fields.

Develop greater efficiency in the industry.

Procedure

First: Bring together the various interests in the larger cities, cause them to formulate a plan to extend the work to the smaller towns and cities of each locality.

Second: To accomplish this, committees should be appointed from each of the four divisions of the industry, forming local committees charged with the duty of making a study of local problems and co-operating in their solution.

Third: Individuals comprising these committees will report their activities to their national associations, causing their national association to take similar national action, looking to the solution of national problems.

Results

To produce harmony and develop co-operation between manufacturers, central stations, jobbers and contractor-dealers.

To produce greater efficiency in the distribution of manufactured products.

To increase per capita consumption of electricity, apparatus, devices and supplies.

Establishment of high-class stores.

Decrease in costs of conducting overlapping trade associations, and saving of personal time incident thereto.

Create a more favorable public opinion.

More Convenience Outlets for More Business How to Sell and Estimate

The Society for Electrical Development, in connection with their "convenience" outlet campaign, have issued a folder entitled, "How to sell and estimate," from which the following extracts are taken:—

Follow the Code

In using the Electrical Code of the National Fire Protection Association, remember this: It prescribes merely the minimum requirements to permit the securing of insurance and generally to pass the city inspectors. Therefore, for the sake of safety, comfort and convenience, it is wise to provide a wider margin. No one ever complains of too many outlets either for lighting or for labor saving devices. A switch in line saves time—and money.

Be a Salesman

Do not try to sell copper wire, plugs and receptacles. They won't enthuse anyone. Sell the Idea of what pleasure they will give by making toasters, fans, percolators, chafing dishes, grills, etc., possible.

How convenience outlets will save backaches, burnt fingers and dirty houses by making electric cleaners, washers, and irons available.

If the housewife says she cannot afford these "luxuries" tell her to buy what she can and these will soon save her in time and labor enough to buy the others. She can buy appliances piecemeal, but wiring can't be done that way.

If anyone ever talks to you about dangers of shock from electricity, tell them it isn't possible with good workmanship. Thousands of people died in their beds last year in Massachusetts from preventable diseases, but not one fatality was due to electricity in the home, according to the official state reports. Then you might add that electricity eliminates the disease of overwork—it saves the price in doctor bills.

Making Estimates

Don't guess on a job. Figure your material, your labor, the time lost between shop and job and leave enough margin to pay you for your time in supervising or inspecting the work.

If you haven't your own blanks, use the forms provided by this Society.

Survey the premises to be wired, measure them up, make

of your costs. Use first class material and see that the work is well done and you make a friend of your client to whom you can sell the many appliances that will surely be wanted when the "convenience outlets" are there.

Don't cut your specification or prices and turn out a bad job.

Explain to your customer that key sockets are designed for 250 watts only, while toasters, percolators, irons, etc., take from 400 to 600 watts. Putting these things on loaded lighting circuits means bad lights and trouble if not danger.

The location of outlets must be determined on each job but there are a few fundamentals to be remembered.

Floor receptacle in dining room should be off the centre of the dining table to avoid leg.

The wall receptacle can be placed in base board, wainscoting or preferably at four feet from the floor in the wall near door or window frame.

Two-way plugs are very useful but should not be used on key sockets for heavy current-consuming appliances.

Convention of B.C. Contractors and Dealers is Finally Fixed for Sept. 13 and 14 in Victoria

The second annual convention of the British Columbia Association of Electrical Contractors and Dealers, which was advertised to be held at Victoria, B.C., on Friday and Saturday, Aug. 16 and 17, has been delayed a month, to permit of perfecting the plans and organization. Capt. W. J. Conway, secretary, in writing of the postponement, repeats the cordial invitation originally offered to any electrical men who may be in the vicinity of Victoria on Sept. 13th and 14th. In the following notice, which is being distributed widely, complete information of the convention is given:

ELECTRICAL MEN EVERYWHERE

are invited to the

SECOND ANNUAL MEETING

of the

B. C. ASSOCIATION OF
ELECTRICAL CONTRACTORS AND DEALERS.

to be held at Victoria, B.C.,
Friday and Saturday, Sept. 13th and 14th, 1918,
Boat leaves Vancouver 10.30 a.m., Friday

MEETINGS BANQUETS PICNIC

THIS IS GOING TO BE THE GREATEST "ELECTRICAL MEETING" EVER HELD IN WESTERN CANADA.

ALBERT ELLIOT OF SAN FRANCISCO WILL BE WITH US

ALL ELECTRICAL MEN

Including Managers, Power Company men, Wholesalers, Engineers, Contractors, Retailers, Salesmen, Etc., and their wives and families are cordially invited to share in this great ELECTRICAL HOLIDAY, and at the same time meet and talk to men in the same business.

For further information, particulars of boats, trains, etc., write or phone to

The SECRETARY,
B. C. ELECTRICAL ASSOCIATION,
406 YORKSHIRE BUILDING,
VANCOUVER, B.C.

Square D News Item Service for Immediate Release

The Square D Company, Walkerville, Ontario, steel enclosed switch manufacturers, call attention to some of the very important features of their Square D safety switches, which are approved by the Hydro-Electric Power Commission of Ontario. The switch is of very simple construction, completely enclosed in a sheet steel box, so designed that ample wiring space is provided inside to make the necessary connections, and the corners of which are electrically welded, thus assuring great durability. The box is provided with a hinged cover, held closed with a simple spring, and the switch is operated by a crank handle located on the outside. Raised letters on the box indicate the "on" and "off" postion of the switch.

The switch may be locked in the "off" position to prevent accidents while repairs are being made on apparatus controlled by it, provision being made for three individual padlocks. The advantages of these are obvious where there is more than one man working on the line or equipment. When each man starts to work, he locks the switch in the "off" position. This eliminates the possibility of either man throwing the switch "on" before all are finished working. Means are also provided to seal or lock the cover shut to prevent unauthorized persons over-fusing the switch or tampering with live connections in any way, but the electrician has access to it at all times and can make his tests or inspection without stopping the motor or delaying production.

The switch is provided with a quick-break mechanism which is absolutely positive and insures a simultaneous break at all blades. This positive action makes longevity of the copper blades and the switch jaws a certainty. Another feature is the interchangeability of end plates, which are furnished blank with knock-outs, or with porcelian outlet covers for open wiring, according to installation requirements. Convenient knock-outs are furnished in the sides of the switch, and make possible "Tapping-off." Their catalog contains description, specifications and prices of these switches, as well as valuable motor wiring data, and will gladly be sent on request.

Mr. Mahoney Leaves Westinghouse

Mr. J. N. Mahoney, for 12 years a member of the Westinghouse engineering department, has tendered his resignation to open consulting offices in New York. For the last 8 years, Mr. Mahoney has been in charge of designing switches, fuses, and circuit breakers for this company and is largely responsible for the progress that has been made in this class of apparatus. Previous to this work he was connected with the railway engineering department in charge of control design. Mr. Mahoney is a member of the American Society of Mechanical Engineers, the American Society of Mining Engineers, the American Institute of Electrical Engineers, and the American Electrochemical Society, and his wide acquaintanceship and broad experience in electrical work should be of great assistance to him in his new field.

Salisbury Electric Co. Ltd., electrical engineers, contractors and manufacturers of electrical supplies, formerly of 49 Wellington St. East, Toronto, announce that they have closed their old offices, and moved to larger and more commodious premises at 615 Yonge St. The new shop will be known as "The Electric Shop," and the building is called "The Electric Building."

Schumacher-Gray Co., Winnipeg, Man., have secured the electrical wiring contract for the additions being made to the Winnipeg General Hospital. This company's tender was $13,350.

Seven Trustworthy Prescriptions for the Business Ills of the Contractor-Dealer

The Society for Electrical Development, now right in the thick of their campaign for an increased installation and use of "convenience" outlets, are sending out a quantity of valuable information designed to assist central stations, contractors, dealers, jobbers and manufacturers to complete and carry through their own organizations. In the July issue of their Monthly Sales Service they give what is described as "Seven trustworthy prescriptions for electrical business ills." It is pointed out that every business, large or small, needes a good tonic from time to time because there are many ailments in the retail electrical industry. For this reason they have prepared these 7 tabloid tonics, which it is hoped will prove of assistance, both internally and externally, to every electrical merchant. These tonics are printed below:

Make Capital Go Further

A fruit peddler can teach you lessons in merchandising. Every morning he buys a load of bananas; before night he's sold out.

Turning over his capital every day, Sundays and holidays, he does a gross business of over $5,000 in nine months on a $9 investment. In forty years he could do a gross business of $292,000 on that capital.

What would he make if he had $9,000 capital?

The average electric shop turnover is supposed to be four to eight. There are retailers who turn their stocks as many as twenty times! How? Why—they keep close records on sales, on purchases. They buy in small quantities—and often. They keep correct records, and use them. They do a big profitable business with little capital.

Better less business—at a profit—than volumes at a loss!

B'guess and B'gosh Retailing

Eliminate guess-work from your methods. Govern your business from knowledge. Learn, look, see, hear, make notes—don't guess.

Why aren't you making profits—when others are? Why don't you grow faster?

The United Cigar Stores Co. doesn't guess! It uses facts as guide posts. "How many people pass a certain place daily?" No guess-work! It counts 'em. That determines location. What goods sell best? It keeps records—and proves it! What clerks deserve first promotion? It watches, checks up and rewards the worthy. It's all the result of simple, self-study—self analysis.

"You haven't the time to do this?"

Do you take time to see your doctor, your dentist? If your business is sick—take the time to doctor it. The ills of the inlustry should be an open book to you! Diagnose your own ailments! Then apply the remedy. Act!

The prescription is "cut out guess-work!" Keep records—even if you have to get outside help to do it.

What Does It Cost You to Do Business?

Records show average cost of doing business among electrical retailers to be over 30 per cent.

A Central Station new-business manager claimed his cost was only 13 per cent. Investigation proved his salary (as well as that of other people who devoted a part or all of their time in this department) was not charged against that department. Nor was light—because "the company made its own current." And there were other items—rent, for instance—not charged against the sales in that business. And he thought he was making a profit on his merchandise, whereas he was losing money daily, with every sale.

In scientifically managed stores the salaries of clerks average 9 per cent. of the gross sales by those clerks. Salaries of managers, bookkeepers, and other employees who do not sell, run the average cost for salaries up to around 14 per cent. of the gross sales.

Rent averages around 4 to 5 per cent.—and is going up. Delivery around 1½ to 2½ per cent. Light and heat about the same.

No electrical dealer should assume these percentages to be his costs. He should get his costs from his own business. These percentages are only standards to enable him to judge whether his own are higher or lower than the average.

Classify your expenses into such accounts as will give you the information you need. Keep tab and record of every item of expense.

You can fool yourself by failing to charge all expenses into your cost of doing business but your expenses will come out of your gross profits just the same.

The Profits in the Sale

A man bought just enough drygoods to take care of one day's sales.

He closed his store at the end of the first day and went to the city to buy more stock; arranged for a good many days' supply to be shipped as needed—one day's supply at a time, cash to be paid on delivery. Now he owns two big stores with net profits of $25,000 a year.

Ninety-five per cent. of all retailers over-buy. Jobbers can prove it.

Few electrical dealers keep adequate stock records.

Hungry salesmen, and overly-ambitious clerks, advise buying heavily against an "advance in price," which doesn't always materialize. Records should show whether to buy or not!

Overhead charges against 11 dozen lamps on the shelves which don't move quickly, eat up the extra quantity discount on the 11 dozen and the percentage which the retailer makes on one dozen lamps.

Keep close record of stock!

Make your stock records show what, when and why to buy in large lots. Buy in small quantities—then you don't lose so much if the goods don't move.

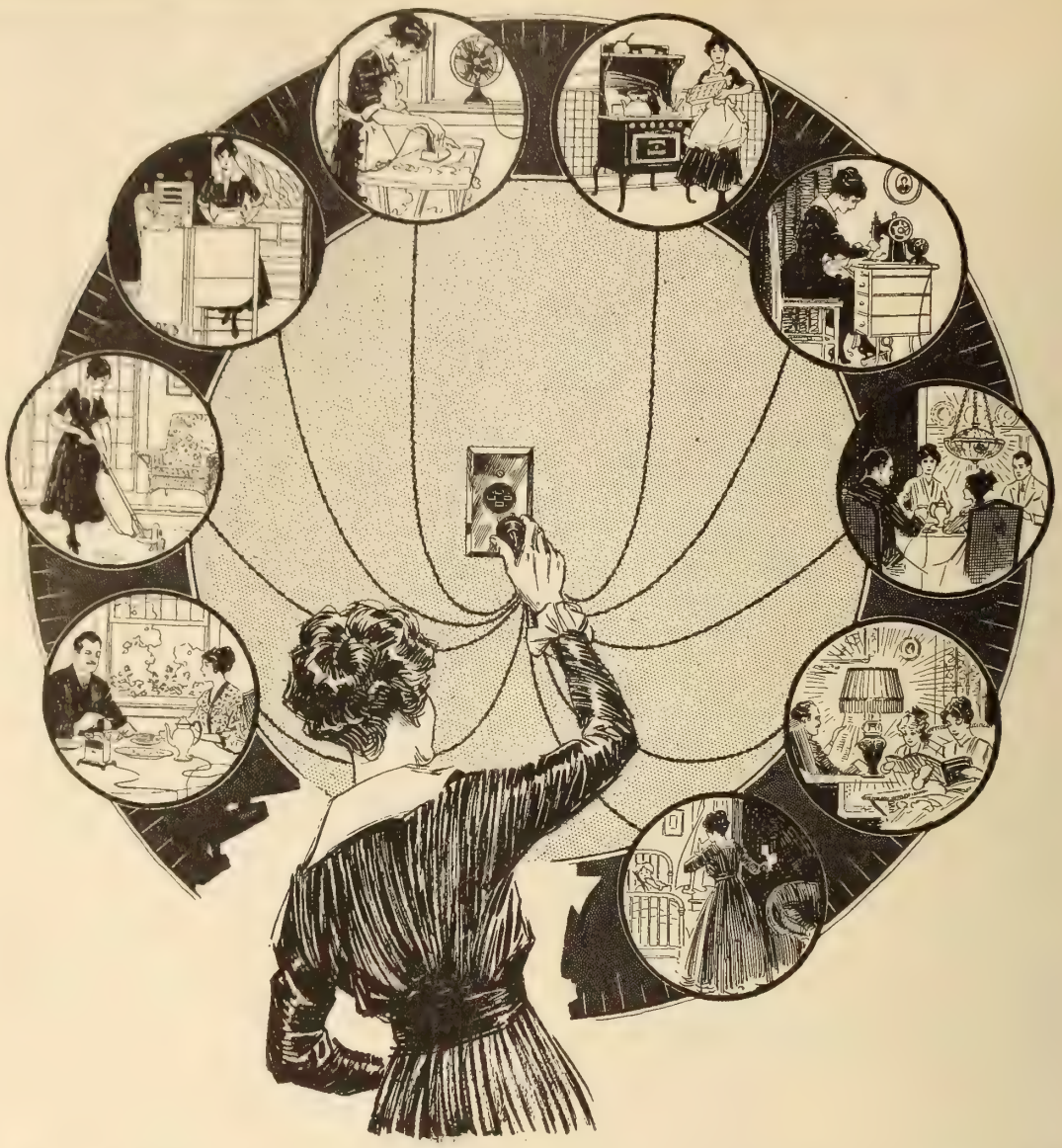
Are You Making Less Than You Think?

Investigations show that a majority of retailers' profits are imaginary. While electrical sales often run to a high figure, profits are on paper.

Many electrical dealers, while estimating their cost of doing business on a certain percentage of the gross business (which is the selling price) add this same percentage to the cost when figuring prices of individual items. This usually results in a loss.

An appliance sold for $9.25 wholesale. Freight and cartage were 75 cents. Total cost $10 set down in the store.

To meet competition profit was cut down to 10 per cent. net. So 18 per cent. of the cost was added for cost of doing business and 10 per cent. for profit, making the sale price



SAVE - FUEL - TIME - FOOD - MONEY - BY WIRE

Electricity lessens every task of housekeeping, home-making.
It saves the housewife, and her help, miles of steps, hours of effort and dollars of expense.
Therefore you should increase the convenience and efficiency of your Electric Service by having your home equipped with

Convenient Service Outlets

These outlets provide handy places where you can "plug-in" your Electrical Appliances without unscrewing bulbs from the fixtures or otherwise disturbing the lighting system . . . . They also do away with dangling wires that are often unsightly and in the way . . . . Inconspicuous, little affairs, set into the floor, base-board, wainscoting or wall. All that can be seen is a small, neat brass or porcelain plate. Can be placed wherever handiest, within arm's reach, in any room. Very easily installed without disfiguring floor or walls, mussing up the house or disturbing the home routine. Study the picture—doesn't it tell an interesting story?

Right Now we are offering a special opportunity for the installation of these Convenient Service Outlets . . . , One of our experts will call at your home—at the time most suitable to you—offer suggestions, help you plan, give full information . . . . There will be no charge for this and you will not be obligated in the least.

An advertisement suggestion by the Society for Electrical Development in connection with their "Convenience Outlet" Campaign—An especially attractive cut—Why should not the Canadian Contractor-Dealer profit by this campaign?

$12.80. The retailer thought he was making a profit of $1.00. But was he? Let's see:

The article cost $10 and he wanted 28 per cent. gross profit (to cover 18 per cent. for cost of doing business and 10 per cent. net profit). He considered the selling price as 100 per cent. and cost price as 72 per cent. or all of that 100 per cent. except the gross profit of 28 per cent.

Now if $10 is 72 per cent. of the selling price, the selling price must be $13.89.

As he worked it out:

Selling Price	100%	
Cost doing business ...	18%	
Net profit desired	10%	
Gross profit	28%	
Wholesale cost	72%	
Cost price, in percentages..	.72	$10.00 cost in money
		13.888 Selling Price

An analysis of the problem shows:

72% = $10

1% = 1/72 of $10 or 10/72

100% = 100 x 10/72 or 1000/72 or $13.888

To prove back the problem:

$13.89 Selling Price	$13.89 Selling Price
.28 Percentage	3.89 Gross Profit
11112	$10.00
2778	
$3.8892 Gross Profit	

Thus, figuring correctly, it took $2.30 of the $2.80 gross profits to cover the 18 per cent. cost of doing business.

It is not claimed that this method of figuring profit on the selling price is the only right method. School arithmetics have always taught that in percentages the cost price is the base. And, it should be remembered that the per cent. of profit added to the cost price is always a profit on the cost price, and not a percentage on the money taken in.

That method is all right. However, as your profit is to come out of the selling price, it is considered by many to be safer to figure on the selling price.

The percentage of profit and the percentage of cost of doing business must be figured on the same base. When they are, you need only be sure that your average mark-up gives the margin of profit you deserve and expect. If you don't have that margin on your books, in your cash drawer, or in the bank, at the end of the inventory period, you should make it your business to find out why. Remember—records will help.

Don't get your percentages mixed. That's the crux of the problem of profit figuring.

Sluggish Sales and Dusty Stock

It pays to handle electrical merchandise that goes fast. Look at your store! See those stocked shelves. Dust covered merchandise means dormant dollars.

Records should show you exactly how much you will sell of every line each day—should show you whether to keep a two week's supply or a month's supply of each line!

Don't pay business-street-level prices for storage space. Either sell the goods or stock them where the rent and insurance won't eat up the profits.

The wise merchant has sold his goods by the time he gets the jobber's bill!

You can't afford to keep records yourself—and do your own selling and outside work too. Hire somebody to do a part of your work for you. Get rid of the slow movers—stick to the easy sellers!

Watch your records—and "Try to sell before you pay."

A Sale is Not a Sale Until You Have the Money

A large percentage of electrical retail business is done on credit. And since the buying power of a dollar today is only about 70 per cent. of what it was in 1914, the dealer finds it positively necessary to bring in his outstanding money. At the same time the tendency and inclination of the customer is to defer paying bills until the last minute, for to him also a dollar is today only worth 70 per cent. of what it was in 1914.

When a sale is made on credit and no record kept, the electric retailer stands to lose the profit, the original cost of the goods, the time involved (invested) in the buying and selling of the goods, the cost of labor in handling, the cost of stocking it on the shelves. Also other losses, including that big one which such carelessness will cause in other work.

Records should show at all times the money outstanding, unpaid accounts, how long accounts are overdue, and so on. Merchandisers had better sell only for cash than attempt to do a credit business with inefficient record-keeping systems, or none at all.

Recent records made in other lines of retail business, show that outstanding accounts today are 50 to 70 per cent. below what they were a year ago—depending upon the locality from which figures were secured.

Keep credit records. Get in the money.

Personals

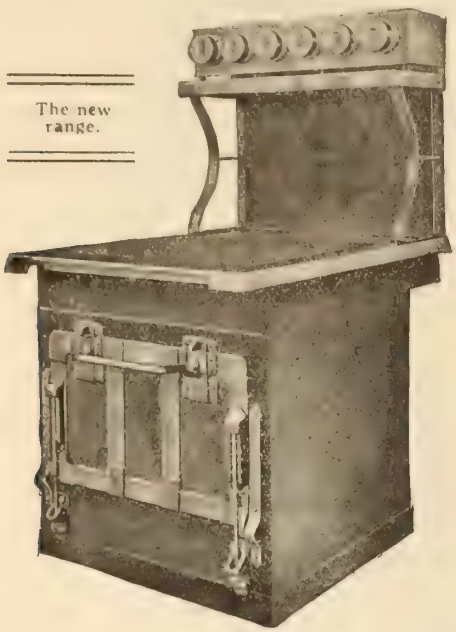
Mr. R. R. Knox, traffic superintendent, Winnipeg Electric Railway Co., Winnipeg, has just received word from his son, Lieut. C. E. Knox, of his marriage in England.

Mr. George A. Hoadley, acting secretary of the Franklin Institute, Philadelphia, has been elected president of the Illuminating Engineering Society for the new year, which begins on Oct. 1, 1918. Mr. Hoadley was formerly professor of physics and electrical engineering at Swarthmore College.

Mr. Frank T. Groome, sales manager of the Benjamin Electric Mfg. Co. of Canada, Ltd., who has recently returned from his Western trip, reports that the Western welcome is just as cordial as ever. While in Vancouver Mr. Groome addressed the Association of Electrical Contractors and Dealers, a very active organization in our coast province, and gave them first hand information on a number of eletrical organizations in Eastern Canada, including the Toronto Electrical Contractors' Association, and The Electric Club of Toronto, with the organization of which Mr. Groome has been so closely associated. Mr. Groome states they are to be complimented on the strength and thoroughness of their organization in the West. The claim that they are 98 per cent. organized is quite correct. In the course of his address Mr. Groome took occasion to urge upon the electrical men of Vancouver and district the advisability of forming a social organization similar to the Electric Clubs of Montreal, Toronto, London, and elsewhere in the East. He explained that these clubs have been very successful in eliminating misunderstanding and friction between the various members of the industry, and in making and cementing many friendships. It is expected that the Electric Club of Vancouver and probably also the Electric Club of Victoria will result, at an early date. A vote of thanks to Mr. Groome for his enthusiastic address was moved by Mr. Mundy, of the Mundy, Rowland Co., and seconded by Mr. J. F. Little, manager of the Northern Electric Co.

New C. G. E. Agency

The Canadian General Electric Company have secured the exclusive agency for Canada for Neuco electric household and hotel ranges and broilers, formerly made by the National Electric Utilities Corporation, recently acquired by Lamlers, Friary & Clark. During the past four years Neuco ranges have won an enviable reputation for rugged



The new range.

design and reliability under the most severe operating conditions. The Neuco electric hotel range shown in this illustration is not only a strong and practical electric range, but its outward appearance is very attractive. The drop doors are protected by spring balances with positive catch, the wrought iron being re-inforced at all points and hinges. This unit is a complete range in itself. Additional units may be placed side by side or back to back to meet the requirements of any size kitchen.

Buss Fuses for Every Purpose.

Rose and O'Hearn, 220 King Street, West, Toronto, are Canadian agents for the Bussman Manufacturing Company, St. Louis, and handle their well-known line of cartridge fuses, auto fuses and plug fuses of every type, size and capacity required for any electrical service. Every "Buss" fuse is claimed to hold an over-load of 10 per cent. indefinitely and blow at 50 per cent. over-load in the time limit allowed by the Underwriters. The company state that catalogue and samples will be mailed on request.

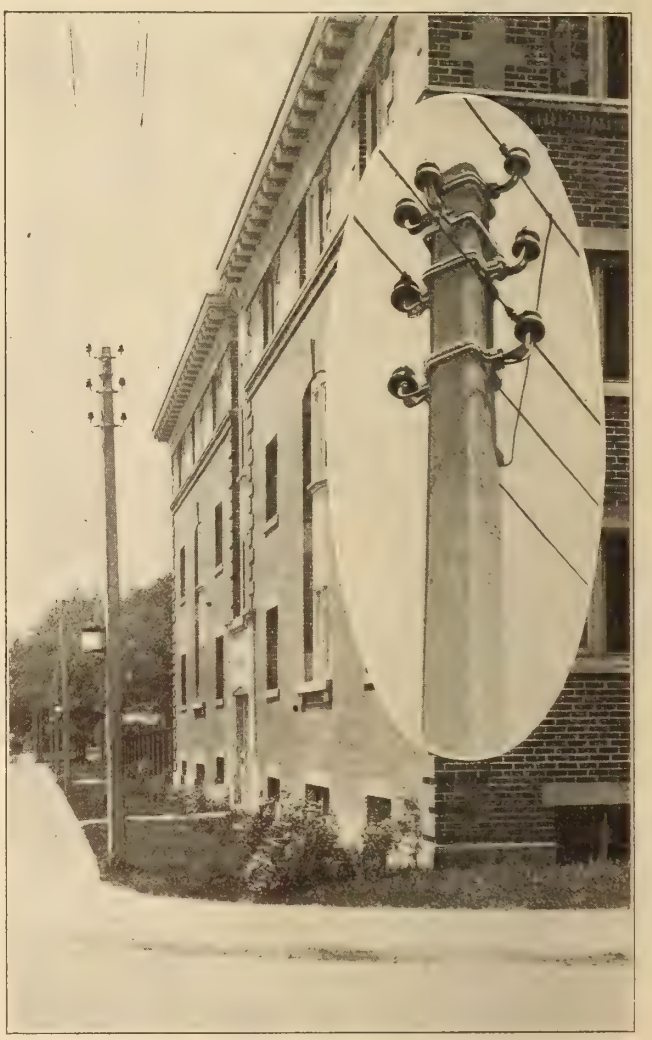
Improving Electrical Distribution on City Streets.

With the steady extension of distribution circuits for electric light, power and heating service, there has been a pressing need for an economical and substantial distribution fixture of neat appearance, and one which will firmly grip the pole without weakening it.

Such a fixture has been invented and patented by F. M. Simpson, Montreal, and the accompanying photograph shows the use of this device on concrete poles in Toronto. Certainly the appearance of the lead is very pleasing not only to one who is familiar with distribution, but to the public generally.

The fixtures or crossarms with accommodation for insulators, are made of steel channels, hot galvanized and rustproof. The attachment portion of the arm which is really the patented feature of the device is in the form of an adjustable collar with the heads of the clamping bolts held by the flanges of the channel, making spring washers or lock nuts unnecessary, to prevent creeping. Labor charges of installation are reduced as the use of a wrench is all that is necessary to make the fixture absolutely rigid. The channel sections render sufficient spring giving tension to meet weather conditions. The pole grip is especially adaptable to concrete and metal poles as these are generally uniform in size. Its use on wooden poles makes the cutting of a gain unnecessary, as the web of the channel bites into the pole and holds the cross arm without the aid of drift bolts or coach screws.

Fixtures having the same principle of pole attachment are made in several forms for two and three wire circuits, and

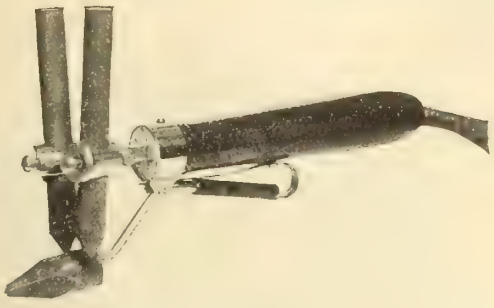


A new distribution fixture.

for carrying strand wire supporting cable. The fixtures are being made in Hamilton by the Acme Stamping and Tool Works. They are "Made in Canada for Canadians."

Mr. E. M. Dechene, deputy minister of the Quebec Department of Lands & Forests, states that the hydraulic service of the department has made an investigation of the water power developments of the province. Leaving out of consideration, nearly all the plants under 1,000 H.P. capacity, on account of the greater difficulty to reach them, the figures already in, give a total of 810,000 H.P. developed. With the smaller plants added the total will probably reach 850,000 H. P.

Remarkable but True



THE NEW

J.C. ELECTRIC SOLDERING IRON

Seven Hours Saved on a Ten-Hour Job

70% Time Saved.



500 H.P. Induction Motor at Burlington Steel Co., Ltd.

Instead of taking ten hours with two men to solder the induction coils of this motor, the J. C. Iron with one man did it in three hours, a remarkable saving in time.

The secret of the wonderful efficiency of this Iron is the fact that it heats only while in contact with the work, and then heats almost instantaneously.

No time is lost at any stage of the work.

Saves Labor, does not require skilled help.

Light in Weight—Rugged in construction.

Can't Burn out, because there is nothing to burn out, and the only Maintenance Cost is for Carbons.

The Fastest, most efficient, and most Economical Electric Soldering Iron on the Market.

The "J.C." Soldering Irons have stepped into the front rank through sheer downright efficiency.

Write for Illustrated Catalogue

Clemens Electrical Corporation

of Canada, Ltd.

Hamilton - - - Ontario.

Current News and Notes

Agincourt, Ont.

Hydro power was formally turned on in Agincourt, on August 9. This is the terminus of the Scarboro Hydro transmission line. Present charges for current are five and a half cents per kw.h. with a sliding scale according to the amount of current used.

Guelph, Ont.

Mr. E. A. Lowry, Guelph, Ontario, has, owing to greatly increased business, moved into new offices in the Herald building, Guelph, and is now better prepared to handle the additional business. Mr. Lowry is now solely handling motors, generators, transformers and large direct connected generating units of all capacities. Mr. Lowry, who has been engaged in the electrical business for a number of years and is an Associate Member of the A. I. E. E., has a well established business covering a large part of the United States as well as practically the whole Dominion.

Montreal, Que.

The Montreal Tramways Company have averted an employees' strike by submitting to a demand for increased wages.

The Montreal & Southern Counties Railway Co., has been successful in its application to the Railway Board for an increase in its passenger and freight rates. Sir Henry Drayton in giving judgment, found that the cost of the service of the company has greatly increased, and the new schedule which the company desires to make effective is just and reasonable. In his opinion an order increasing them should be issued notwithstanding any municipal agreement to the contrary. The company has agreements as to the rates to be charged with St. Lambert, Greenfield Park, and Longueuil, and it was contended that these agreements were a bar to any increase. Sir Henry Drayton, however, over-ruled this argument, pointing out that to increase the tolls in other districts without increasing them in the municipalities referred to would produce a different scale of tolls.

North Sydney, C.B.

The Sydney Mines Electric Company have raised the rate for house lighting from 11 to 14 cents per kw.h.

Portage La Prarie, Man.

The city council of Portage la Prairie, Man., will submit a by-law to the ratepayers authorizing a debenture issue of $325,000 for the purpose of constructing a transmission line from Winnipeg and bringing in Hydro-electric power.

Preston, Ont.

The Leverson Electric store at Preston, Ont., suffered considerable loss in the fire which recently destroyed a large portion of the business section.

Regina, Sask.

In connection with a recent by-law in Regina authorizing an expenditure of $175,000 for a new generating unit, the light and power department, (Mr. E. W. Bull, superintendent), have purchased a 5,000 kw. 2300 volt, 3 phase, 60 cycle C.G.E. turbo-generating unit and a Westinghouse LeBlanc surface condenser. The generator and condenser will be shipped by the manufacturers in a few weeks and will be installed and in operation by Christmas.

St. Thomas, Ont.

The employees of the St. Thomas municipal electric railway, now receiving 25 cents an hour for a nine and a half hour day, are demanding 35 cents. The cost of living, they say, has advanced 120 per cent.

The city council of St. Thomas have under consideration scrapping the present street railway system and installing electric omnibuses, running on storage batteries, without rails. The system at present is facing a heavy deficit, and it was pointed out that with these cars in operation $10,000, or over, a year could be saved in wages. There would also be a saving in power bills and there would be $15,000 worth of scrap rails to dispose of.

Toronto, Ont.

The total current expenditure of the Toronto Hydro Electric system during the first quarter of the year, according to a report of General Manager H. H. Couzens, was $356,251. The total receipts were $620,066, leaving $263,814 available for fixed charges. There is a reserve of $21,000 for contingencies, and $107,619 available for depreciation. The balance sheet shows assets amounting to $10,494,077. The surplus, as per revenue account, including $69,958, brought forward from 1917, is $177,305.

The Toronto and York Radial Company have put an order into effect which forbids the carrying of baby carriages on Saturdays, Sundays, and holidays. Passengers may check their go-carts at the station or leave them at home.

Passenger traffic on the Toronto civic car lines increased during July to 22.5 per cent. over the same month last year. The revenue for July this year was $28,285 and for July 1917, $23,262.

A Toronto man undertook some electrical installations and alterations without securing a permit. He paid $50 and costs for his neglect, the Crown Attorney pointing out the great danger arising from defective electrical work, not only to the building in which it was installed, but also to the whole neighborhood.

Windsor, Ont.

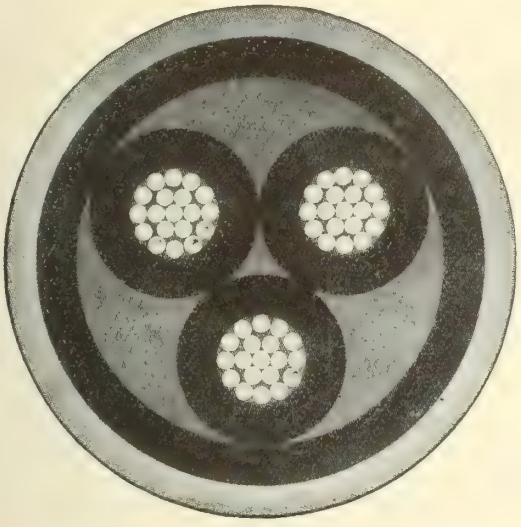
The Essex Terminal Railway Company will, it is stated, apply for permission to establish a straight five cent fare in place of the six-for-a-quarter tickets which have been in use.

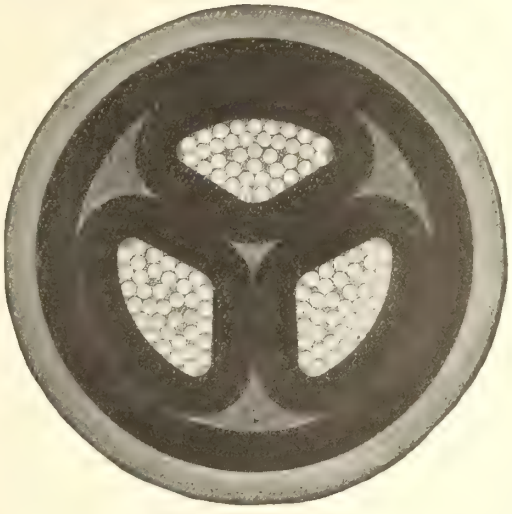
Electrical Research Committee.

The British Electrical Research Committee, which was appointed last autumn, under the auspices of the Department of Scientific and Industrial Research, is at present engaged in superintending a research on insulating materials (fibrous materials, porcelain, ebonite, mica, composite materials), and the water-proofing treatment of insulating windings of electrical machines, in respect of which grants have been made to the committee by the Research Department, the B. E.A.M.A., and the Institution. The committee consists of three members nominated by The Institution of Electrical Engineers and three members nominated by The British Electrical & Allied Manufacturers' Association, the nominees of the former being Mr. C. H. Wordingham, C.B.E. (Chairman of the Committee), Mr. C. C. Paterson, O.B.E., and Mr. C. P. Sparks, and those of the latter Mr. F. R. Davenport, Mr. D. N. Dunlop, and Mr. A. R. Everest. The temporary address of the committee is No. 1 Albermarle Street, London, W. I., and its secretary is Mr. P. F. Rowell.

PHILLIPS' CABLES

as supplied to the Toronto Hydro Electric System





These illustrations show cross sections in the original size of cables recently supplied to the T. H. E. System and reordered by them for further extensions. The specifications are as follows.—Conductors composed of 37 strands each, .082 in. diameter. Thickness of dielectric on each conductor, .210 in. Thickness in belt, .210 in. Thickness of lead sheath, .160 in. Overall diameter, 2.61 in., 250,000 C.M. Three Conductor, Paper Insulated, and plain Lead Covered Cable for 13,200 volts. We can supply you with wires and cables of any size for Power, Lighting, Telephone, Telegraph, etc.

Write us for detailed information.

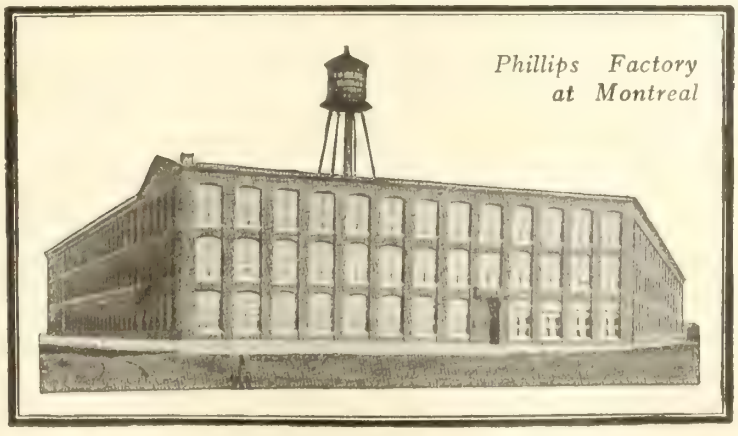
NOTE.—Specification of cable in left-hand cut: 3/0 B. and S. Three conductor. Each conductor 19 strands, each .094 in. diam. Thickness of dielectric on each conductor, .21 in. Thickness of dielectric on belt, .21 in. Thickness of lead sheath, .15 in. Overall diameter, 2.60.

Specification of cable in right-hand cut: As stated in copy.

Eugene F. Phillips Electrical Works, Ltd.

Head Office and Factory: MONTREAL

Branches: Toronto Winnipeg Regina Calgary Vancouver



Phillips Factory at Montreal

BOILERS

For Immediate Sale

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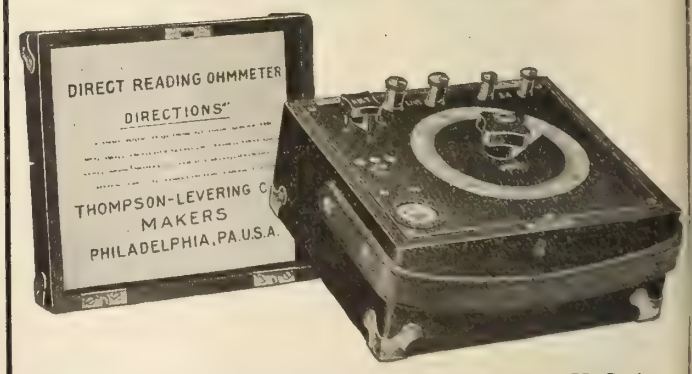
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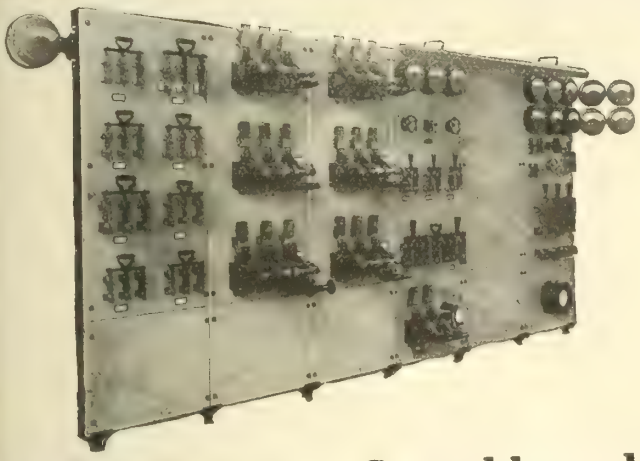
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1	½	G.E.	NEW.. 110	KT	1800
1	½	G.E.	 110	I	1800
5	1	G.E.	NEW . 220	KT	1800
1	1	Fbks. M.	... 440	B	1200
4	3	Wstgh.	New. 220	CS	1130
2	3	R&M	NEW. 220		1150
2	3	G.E.	 220	KT	1800
1	3	G.E.	220	KT	900
3	3	G.E.	 220	KT	1200
1	3	Cr. Wh.	 220		1720
3	5	Cr. Wh.	... 220	Q	1720
1	5	Cr. Wh.	... 550	Q	1720
1	5	Wstgh.	 220	CCL	1700
8	5	Wstgh.	New. 220	CCL	1700
53	7	G.E.	(motors only) 550		1200
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2	7½	G.E.	NEW . 220	KT	1800
1	7½	G.E.	NEW .220	KT	1200
6	7½	G.E.	(motors only) 550	KT	1800
2	7½	G.E.	NEW . 220	KT	900
2	10	G.E.	NEW . 220	KT	1800
1	10	Wstgh.	 220	CCL	1700
1	10	Wstgh.	 220	CS	1150
1	10	Cr. Wh.	with resistance type starter 550	Q	1800
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1	10	Robbins & M	220	K	1750
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2	15	Wstgh.	New. 440	CS	1155
1	15	G. E.	 220	I	900
1	15	Wstgh.	 220		1155
2	15	G.E.	NEW . 220	KT	900
2	15	Fbks. M.	220/440	KBV	1200
2	20	Wstgh.	 220	CS	1160
50	20	Fbks. M.	220 440	KBV	1200
13	25	Wagner..	220/440	KBV	1200
2	30	Wagner	New 220		850
1	35	G.E.	 220	KT	600
1	35	Triumph.	220/440		900
1	40	Wagner	NEW . 220/440	BP	850
1	40	Fbks. M.	 220		900
1	35	G.E.	NEW . 220	M	900
1	35	Westgh.	 220		1170
1	40	Westgh.	New 220	CS	870
1	50	Westgh.	 220		860
1	50	Triumph	 220		720
1	50	Allis-Chal.	. 220		1750
1	75	Allis-Chal.	. 550		690
1	75	Westgh.	New 440	CS	720
1	100	Allis-Ch.	. . 550		690
1	100	G.E.	 550	K	600
1	100	G.E.	NEW . 550	M	600
1	100	Westgh.	 440		1200
1	125	G.E.	 220	L	600
1	150	G.E.	NEW . 220	M	580

3 PHASE, 25 CYCLE MOTORS

Qu.	H.P.	Make	Volts	Type	Speed
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1	12½	G.E.	elev.type-high torque 220	KTE	750
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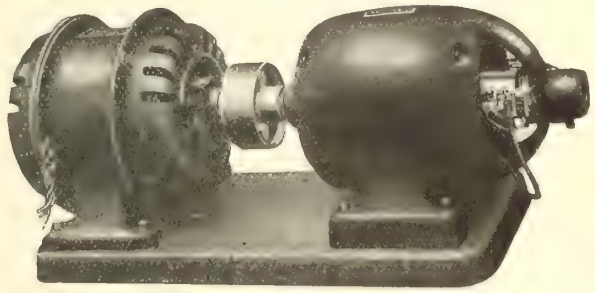
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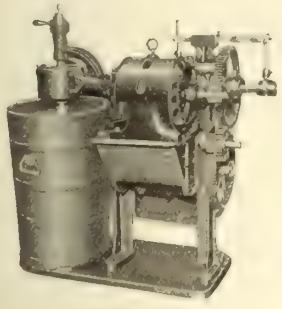
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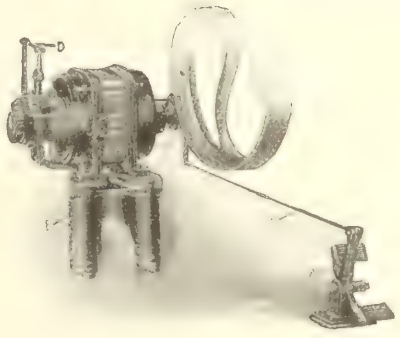
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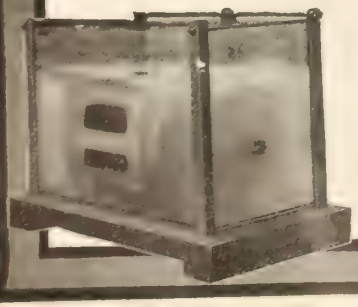
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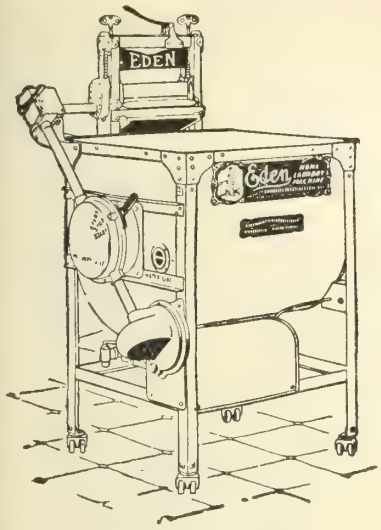
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Canadian Westinghouse Company
Chicago Fuse Manufacturing Company
Crouse-Hinds Company of Canada, Limited.
G. & W. Electric Specialty Company
Hatheway & Knott, Inc.
National Metal Molding Company
Pringle, R. E. T.

BOXES (Manhole)
Philadelphia Electric Co. Supply Dept.
Standard Underground Cable Company of Canada, Limited.

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Acme Stamping & Tool Works, Limited
Canadian General Electric Company
Joyner, Limited, A. H. Winter
Pringle, R. E. T., Ltd.

BRAKES
Sundh Electric Company

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Moloney Electric Company of Canada

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Philadelphia Electric Co. Supply Dept.
Steel City Electric Company

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Canadian General Electric Company
Canada Wire & Cable Company
D. & W. Fuse Company
Northern Electric Company
Phillips Electrical Works, Eugene F.
Standard Underground Cable Company of Canada, Limited.

CABLE ACCESSORIES
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Northern Electric Company
Standard Underground Cable Company of Canada, Limited.
Steel City Electric Company

CABLE END BELLS
Philadelphia Electric Co. Supply Dept.

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Calebaugh Self Lubricating Carbon Co.

CARBONS
Canadian Westinghouse Company

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Ohio Brass Company

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Boving Hydraulic & Engineering Company
Canadian Allis-Chalmers Company

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Jones & Glassco

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Canadian General Electric Company
Lincoln Electric Company of Canada
Pringle, R. E. T.

CHRISTMAS TREE OUTFITS
Northern Electric Company

CIRCUIT BREAKERS
Canadian General Electric Company
Cutter Electric & Manufacturing Company
Ferranti Electrical Company of Canada
Northern Electric Companny
Sundh Electric Company

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Philadelphia Electric Co. Supply Dept.

CLAMPS, INSULATOR
Philadelphia Electric Co. Supply Dept.

COILS
Cleveland Armature Works
D. & W. Fuse Company

COMPOUNDS
Redmanol Chemical Products Company

COMMERCIAL AGENCY
Bradstreet Company

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Cleveland Armature Works

CONDENSERS
Boving Hydraulic & Engineering Company
Canadian Westinghouse Company

CONDUCTORS
British Aluminium Company
National Metal Molding Company
Northern Aluminum Company

CONDUITS
American Conduit Company
Conduits Company
Flexible Conduit Company
National Metal Molding Company
Northern Electric Company
Orpen Conduit Company

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Ferranti Electrical Company of Canada
Lincoln Electric Company of Canada

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Killark Electric Manufacturing Company
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Canadian General Electric Company
Canadian Westinghouse Company
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CONNECTORS
Dossert & Company

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Canadian Westinghouse Company
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Philadelphia Electric Co. Supply Dept.

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Boving Hydraulic & Engineering Company

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See Directory of Engineers.

ELECTRIC HEATERS
National Electric Heating Company

ELECTRIC SHADES
Jefferson Glass Company

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Canadian General Electric Company
National Electric Heating Company
Northern Electric Company

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Canadian General Electric Company
Crouse-Hinds Company of Canada, Limited.
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Canadian Allis-Chalmers Company

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Canadian Westinghouse Company
Century Electric Company
Great West Electric Company
Northern Electric Company
Pringle, R. E. T.
Robbins & Myers

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Spaulding & Sons Company, J.

FIBRE (Vulcanized)
Spaulding & Sons Company, J.

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Hatheway & Knott, Inc.
Northern Electric Company

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Northern Electric Company
Tallman Brass & Metal Company

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Spielmann Agencies Registered

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Tubular Woven Fabric Company

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Crouse-Hinds Company of Canada, Limited.

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Canadian Westinghouse Company
Chicago Fuse Manufacturing Company
Daum, A. F.
Detroit Fuse & Manufacturing Company
Economy Fuse & Manufacturing Company
G. & W. Electric Specialty Company
Hatheway & Knott, Inc.
Moloney Electric Company of Canada
Northern Electric Company
Square D Company

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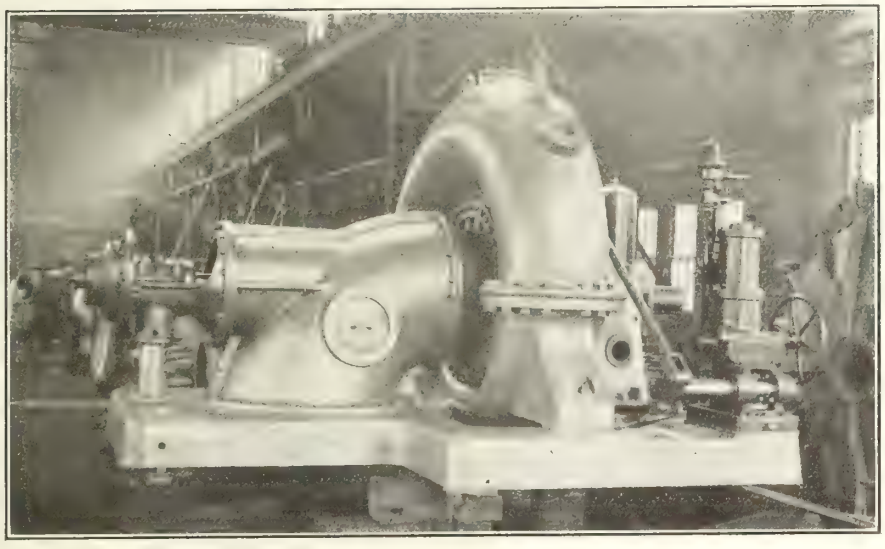
THIS TRADE MARK J O B IS YOUR GUARANTEE

Made in Canada

Water Turbines

Hydraulic Governors

Turbo Pumps



High Efficiency

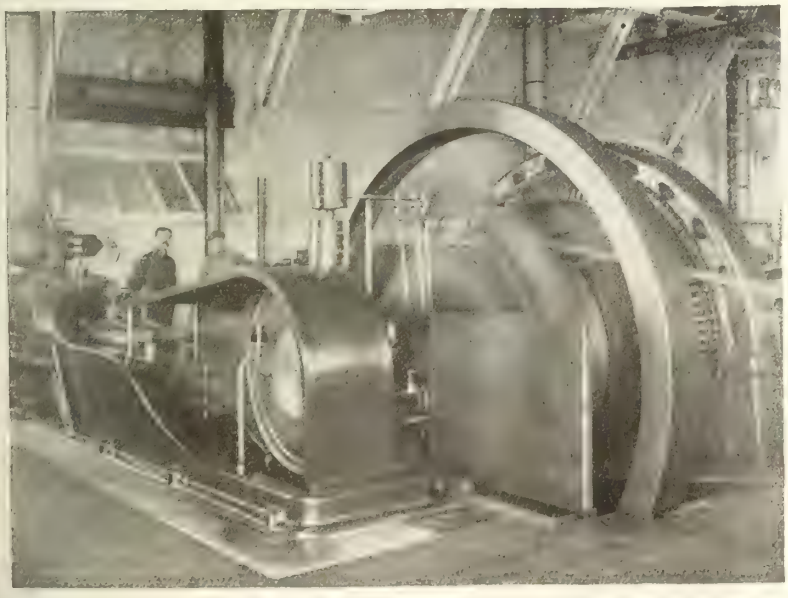
Substantial Construction

Continuous Service

BOVING HYDRAULIC & ENGINEERING CO., LIMITED

LINDSAY - ONTARIO

25 Cycle Engine Generator Sets For Sale



These units were in use only 300 K.W. three months, and 250 K.W. seven months, and are in first class condition.

1—250 KW.

1—300 KW.

25 Cycle, 3 Phase, Westinghouse Generators, Direct Connected to McIntosh & Seymour Cross Compound Gridiron Valve Engines, 150 R.P.M.

1—60 K.W., 60 Cycle, 3 Phase, 2300 Volt Generator

1—100 K.W., 25 Cycle, Motor Generator Set

1—100 K.W. Direct Current Engine Generator Set

1—12 x 24 x 30 Wheelock Tandem Compound Engine

Write for further particulars and quotations

Power Plant Equipment Co., Dominion Bank Bldg. **Toronto, Ont.**

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Northern Electric Company
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Canadian General Electric Company
Canadian Westinghouse Company
Canadian Vickers, Limited
Electrical Maintenance & Repairs Company
Ferranti Electrical Company of Canada
Lancashire Dynamo & Motor Company
Lincoln Electric Company of Canada
Power Plant Equipment Company
Railway and Power Engineering Corporation
Thomson Company, Limited, Fred
Toronto & Hamilton Electric Company

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McGill Manufacturing Company

HANGERS (Cable)
Standard Underground Cable Company of Canada, Limited.

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Canadian Vickers, Limited
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National Electric Heating Company
Northern Electric Company
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Jones & Glassco

HYDRO ELECTRIC MACHINERY
Canadian Allis-Chalmers Company

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Canadian Inspection and Testing Laboratories

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Spaulding & Sons Company, J.
Spielmann Agencies, Regd.

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Canadian Westinghouse Company
Hatheway & Knott, Inc.
Weston Electrical Instrument Company

INSTRUMENTS—RECORDING
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Northern Electric Company

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Redmanol Chemical Products Company

INSULATION (Hard Fibre)
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Canadian Westinghouse Company
Crouse-Hinds Company of Canada, Limited.
Electrical Development Machine Company
Hatheway & Knott, Inc.
Illinois Electric Porcelain Company
Moloney Electric Company of Canada
Mica Company of Canada
Northern Electric Company
Ohio Brass Company
Philadelphia Electric Co. Supply Dept.

INSULATING CLOTH
Packard Electric Company

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Canadian General Electric Company
Canadian Westinghouse Company
Flexible Conduit Company
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Jefferson Glass Company

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Electrical Maintenance & Repairs Company
Hatheway & Knott
High Efficiency Lamp Company
Lincoln Electric Company of Canada
Moloney Electric Company
Northern Electric Company

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Duncan Electrical Company
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Electric Service Supplies Company
Moloney Electric Company of Canada
Northern Electric Company

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Canadian General Electric Company
Northern Electric Company
Ohio Brass Company
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Steel Company of Canada, Limited
Steel City Electric Company

LIGHTING STANDARDS
Adams-Bagnall Electric Company
Canadian General Electric Company
Joyner, Limited, A. H. Winter
Northern Electric Company
Pringle, R. E. T.

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Canadian Westinghouse Company

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Northern Electric Company
Thompson-Levering Company

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National Metal Molding Company
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Chamberlain & Hookham Meter Company
Ferranti Electrical Company of Canada
Great West Electric Company
Northern Electric Company
Packard Electric Company
Rose & O'Hearn

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Kent Bros.
Mica Company of Canada

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Canadian General Electric Company
Canadian Westinghouse Company
Canadian Vickers
Century Electric Company
Electrical Engineering Company
Electrical Maintenance & Repairs Company
Ferranti Electrical Company of Canada
Fisher Electric Company
Great West Electric Company
Lancashire Dynamo & Motor Company
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Petrie, Limited, H. W.
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Sachsenmaiere Company, Geo.
Thomson Company, Limited, Fred
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Spielmann Agencies, Registered.
Standard Underground Cable Co. of Canada

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Fetherstonhaugh & Hammond
Marion & Marion
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Ohio Brass Company

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Pringle, R. E. T.

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Lindsley Bros. Company
Northern Electric Company

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Hubbell Company, Harvey
Northern Electric Company
Steel Company of Canada, Limited

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Canadian Porcelain Company
Hatheway & Knott, Inc.
Illinois Electric Porcelain Company
Ohio Brass Company

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Electrical Development & Machine Company
G. & W. Electric Specialty Company
Joyner, Limited, A. H. Winter
Northern Electric Company
Philadelphia Electric Co. Supply Dept.
Standard Underground Cable Company of Canada, Limited.

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Boving Hydraulic & Engineering Company

PROTECTIVE DEVICES
Philadelphia Electric Co. Supply Dept.

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Boving & Company of Canada
Canadian Allis-Chalmers Company

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Canadian General Electric Company
Benjamin Electric Manufacturing Company
Hubbell Company, Harvey
Northern Electric Company
Pringle, R. E. T.

REGULATORS
Sundh Electric Company

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Electrical Maintenance & Repairs Company

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Electrical Maintenance & Repairs Company
Thomson Company, Fred

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Philadelphia Electric Co. Supply Dept.

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Canadian Westinghouse Company
Sundh Electric Company

RODS
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ROSETTES
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Duncan Electrical Company
National Metal Molding Company
Northern Electric Company
Pringle, R. E. T.

SOCKETS
Benjamin Electric Manufacturing Company
Canadian General Electric Company
Crouse-Hinds Company of Canada, Limited.
Duncan Electrical Company
National Metal Molding Company
Northern Electric Company

(Continued on Page 54)

SQUARE D

SWITCHES

THE ORIGINAL SAFETY SWITCH

Production without Interruption

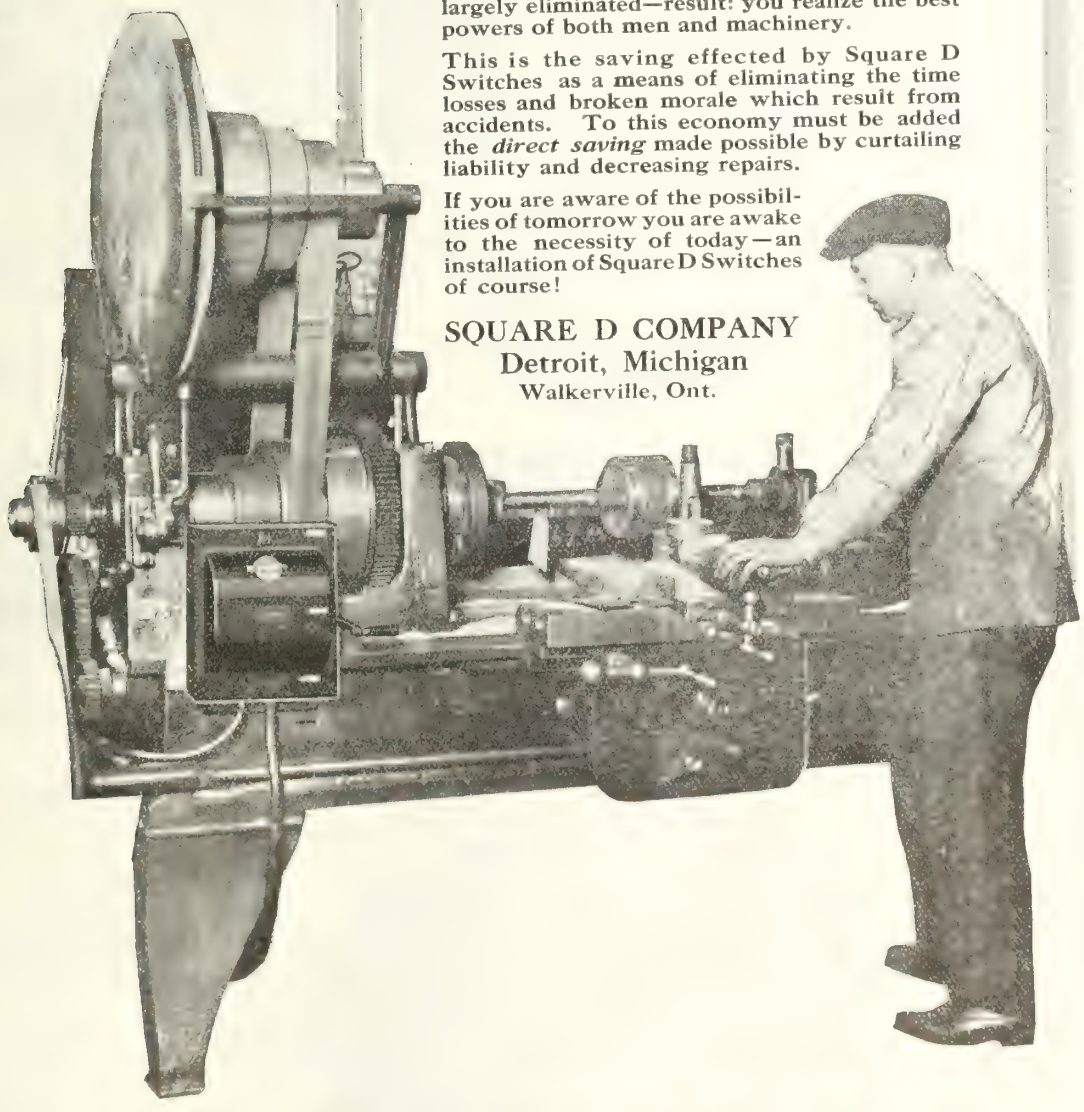
Only the machinery and men which *keep* producing can be classed as genuine assets.

When accidents to men and motors are reduced to the vanishing point by Square D Switches, the production-dwarfing delays which follow as an inevitable consequence of accidents, are largely eliminated—result: you realize the best powers of both men and machinery.

This is the saving effected by Square D Switches as a means of eliminating the time losses and broken morale which result from accidents. To this economy must be added the *direct saving* made possible by curtailing liability and decreasing repairs.

If you are aware of the possibilities of tomorrow you are awake to the necessity of today—an installation of Square D Switches of course!

SQUARE D COMPANY
Detroit, Michigan
Walkerville, Ont.



SQUARE D SWITCHES
do not hinder production

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Allen Company, L. B.
Bissett & Webb, Ltd

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Weston Electrical Instrument Company

STORAGE BATTERIES
Canadian General Electric Company
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Northern Electric Company

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Benjamin Electric Manufacturing Company
Canadian General Electric Company
Crouse-Hinds Company of Canada, Limited.
Joyner, Limited, A. H. Winter
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Canadian Westinghouse Company
Chamberlain & Hookham Meter Company
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Electrical Development & Machine Company
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G. & W. Electric Specialty Company
Hatheway & Knott, Inc.
Moloney Electric Company of Canada
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Square D Company

SWITCHBOARDS
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Canadian Westinghouse Company
Crouse-Hinds Company of Canada, Limited.
Devoe Electric Switch Company
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Moloney Electric Company
Northern Electric Company
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Ferranti Electrical Company of Canada

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Northern Electric Company

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Renfrew Electric Company
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Thordarson Electric Manufacturing Company

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Canadian General Electric Company
Canadian Westinghouse Company
Ferranti Electrical Company of Canada
Kuhlman Electric Company
Moloney Electric Company of Canada
Northern Electric Company
Packard Electric Company
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Rose & O'Hearn
Thordarson Electric Manufacturing Company
Wagner Electric Mfg. Company of Canada

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Canadian Bridge Company

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TURBINES
Boving Company of Canada
Canadian Allis-Chalmers Company
Smith Company, S. Morgan

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Northern Electric Company
Standard Underground Cable Co. of Canada, L

VACUUM CLEANERS
Houston & Company
Onward Manufacturing Company
Pringle, R. E. T.

VARNISHES
Spielmann Agencies, Regd.

VIOLET RAY APPARATUS
Branston & Company, Chas. A.

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Onward Manufacturing Company

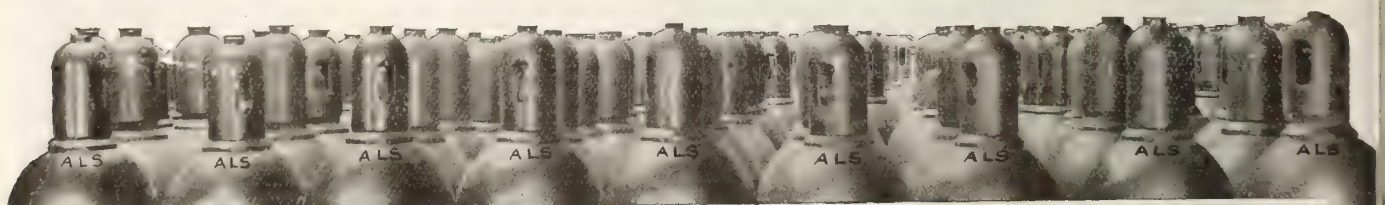
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Boving Hydraulic & Engineering Company
Smith Company, S. Morgan

WATER WHEELS
Canadian Allis-Chalmers Company

WELDING EQUIPMENT
Lincoln Electric Company of Canada

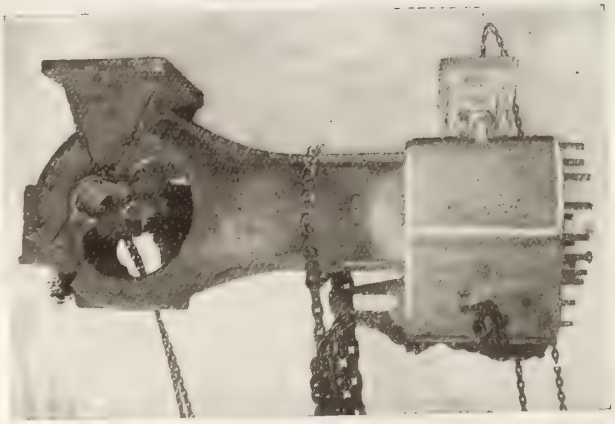
WIRE
Boston Insulated Wire & Cable Company, L
Canada Wire & Cable Company
D. & W. Fuse Company
International Nickel Company
Northern Electric Company
Phillips Electrical Works, Ltd., Eugene F.
Standard Underground Cable Company of C
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1500 lb. Gas Engine Cylinder cracked by frost and reclaimed by Oxy-Acetylene Welding

Over 80% of the material that appears to be only fit for scrap can be used over again practically equal to new by welding the parts together by the Oxy-Acetylene Process.

This not only means saving the actual cash value of the material reclaimed, but relieves the situation brought about by the excessive demand for metals of every description.

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The Pioneers of the Process throughout the World

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Bare and Insulated Electrical Wires for all purposes

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Prompt shipments from Factory or nearest Warehouse

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THORDARSON ELEC. MFG. CO. CHICAGO



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Day after day, week after week, month after month, for the five years that Economy Fuses have been on the market, the sales have maintained a constant growth—not alone in volume, but also in percentage of increase. This is because

ECONOMY Renewable FUSES

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ECONOMY FUSE & MFG. CO. OF CANADA, LTD.
UNITY BUILDING - MONTREAL
Manufacturers in Canada of S. & C. High Potential Fuses—to 150,000 Volts

ALLEN FLUX

Non-Acid Flux for Soldering—Anything—Any Metal to any Metal

at it since '93

Makes joint three times as strong as muriatic acid flux. Only sodering flux approved by National Board of Fire Underwriters.

In four forms—stick, paste, salts, liquid. Sample free.

BISSETT & WEBB
126 LOMBARD, WINNIPEG, MAN., CANADA.

ALUMINUM
ELECTRICAL CONDUCTORS

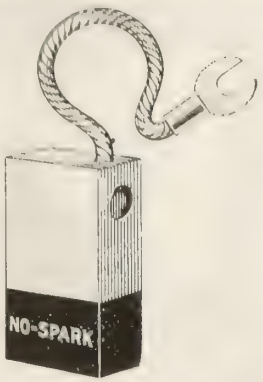
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1305-6 Traders Bank Bldg.
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The Chief Benefit

derived from

"No Spark"



CARBON BRUSHES

IS FREEDOM FROM TROUBLE REPLACING AND RESETTING BRUSHES. Being self-lubricating, they make the contacts practically frictionless and reduce commutator repairs enough to pay for themselves several times over. With these carbon brushes, the machine runs noiselessly without any sparking. These are facts which you can at once prove.

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Self-Lubricating Carbon Co.
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The Erico Bond Welder

The combined weight of the rheostat and furnace, which comprise the equipment of the

Erico Portable

is approximately 200 pounds, which enables easy removal from tracks insuring no holdup of traffic.

The outfit installs the standard **ERICO** rail bond, allowing no flame or arc to strike either rail or bond.

The Rheostat is especially adapted for arc welding purposes of all kinds.

We will be pleased to furnish full particulars upon request in regard to our very efficient equipment.

THE ELECTRIC RAILWAY IMPROVEMENT CO.
CLEVELAND, OHIO



HEMCO
(Trade Mark)

660 Watts Tu-Lite 250 Volts

A Fixture That Increases Electric Lighting Convenience

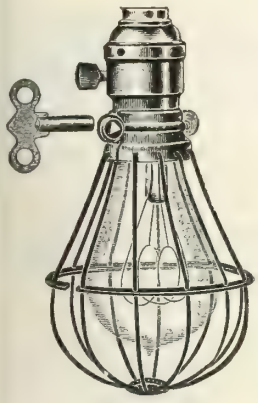
Connections can never be broken. They are solidly moulded in hard insulating material.

Neat in design, will not tarnish, and is practically unbreakable. Can be used under a shade.

APPROVED BY HYDRO-ELECTRIC POWER COMMISSION

We are now prepared to make immediate deliveries from stock

HESSCO ELECTRIC MFG. CO.
210 Adelaide Street West, TORONTO



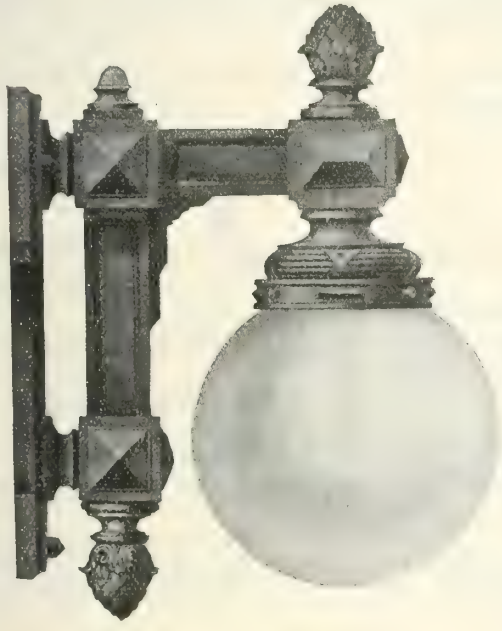
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From Theft or Breakage LOXON Does It!

One turn of the key and the lamp can't come out. Loxon, the lamp guard, is popular all over America. It sells at a single price at a single glance.

Many other electrical specialties which will make money for you. Get in touch with us. Illustrated price lists free.

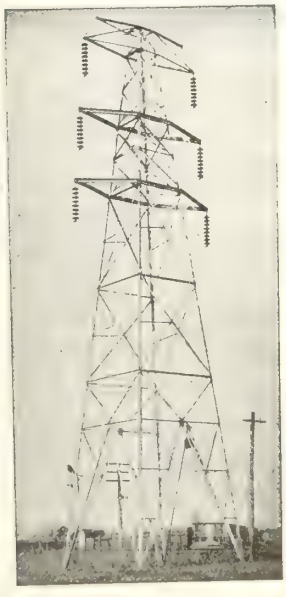
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Bronze or Cast Iron Brackets
for
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Standard Tower of the Hydro Electric Power Commission of Ontario

The modern means of supporting overhead wires.

Power
Telephone
and
Trolley
Lines

We shall be pleased to furnish designs and estimates upon request.

The Canadian Bridge Co., Limited
Walkerville, Ontario, Canada
Structural Steel of all Kinds
Montreal Office in New Birks Building.

Electrical Machinery and Repairs



Armatures Complete, Armatures Rewound, Armature Coils, Armature Shafts, Field Coils
Commutators New, Refilled or Assembled

Cleveland Armature Works
Cleveland, Ohio

CUT THE COST

of your pole lines by using our

British Columbia Cedar Poles

They last longer, look better, and cost less to erect than any other kind. Treated with Carbolineum or Creosote they make you a big saving. Full information without any obligation from our nearest office.

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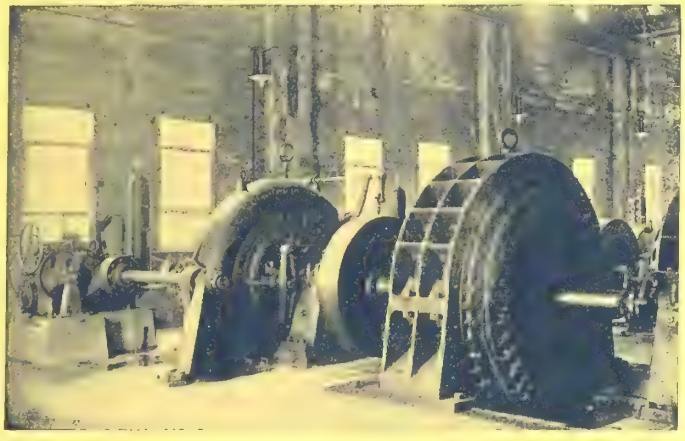
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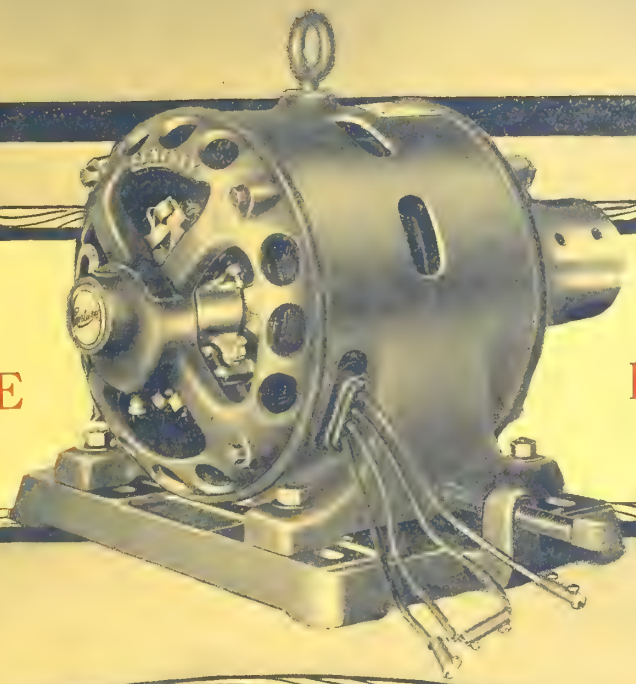
The National Electric Heating Co., Limited
TORONTO, CANADA

Vol. XXVII No. 17 Toronto, Sept. 1, 1918

Electrical News

Generation, Transmission and Application of Electricity

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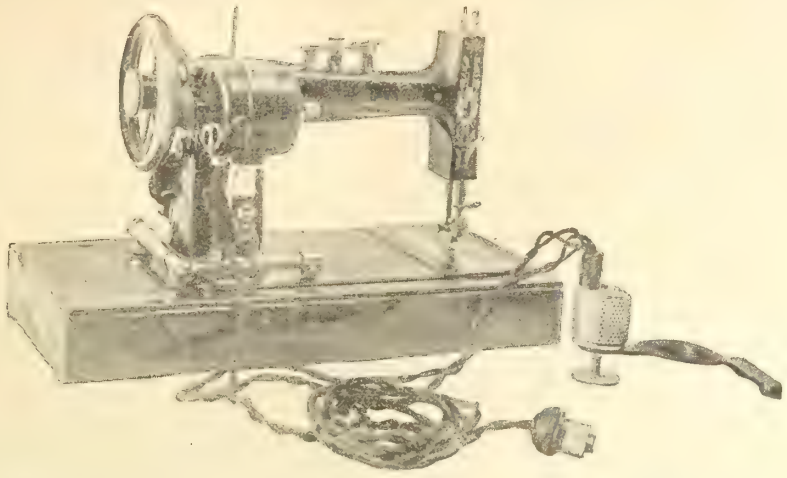
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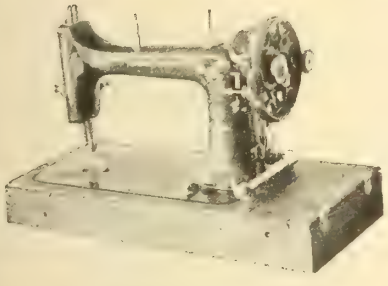
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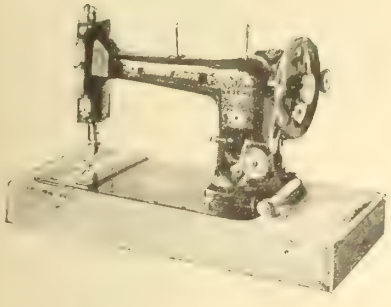
—but when the fall buying season comes, will you be ready?



Why Not Order a Good Supply of

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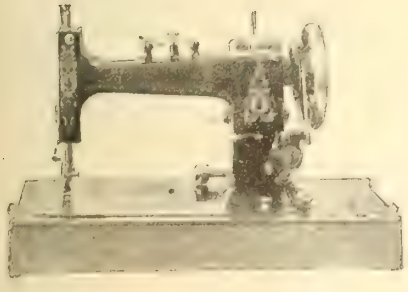
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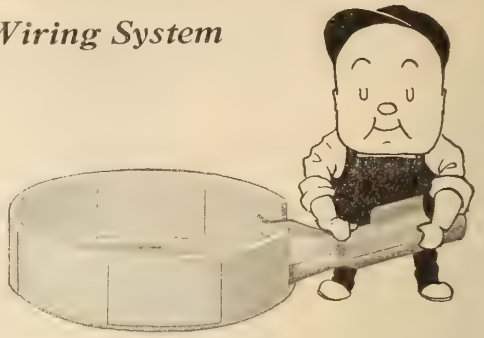
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No. 222

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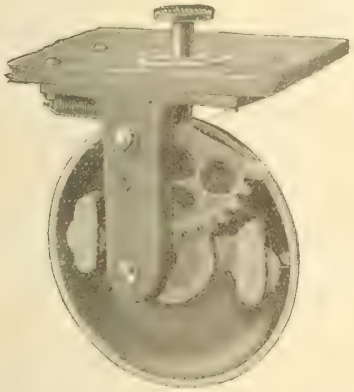
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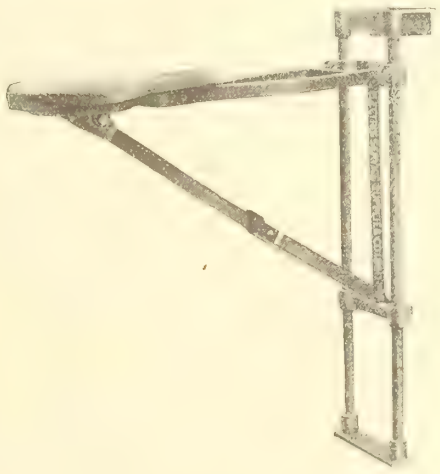
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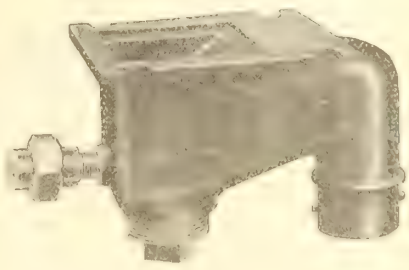
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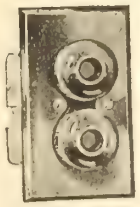
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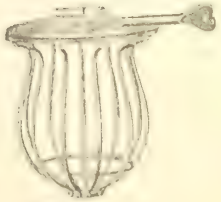

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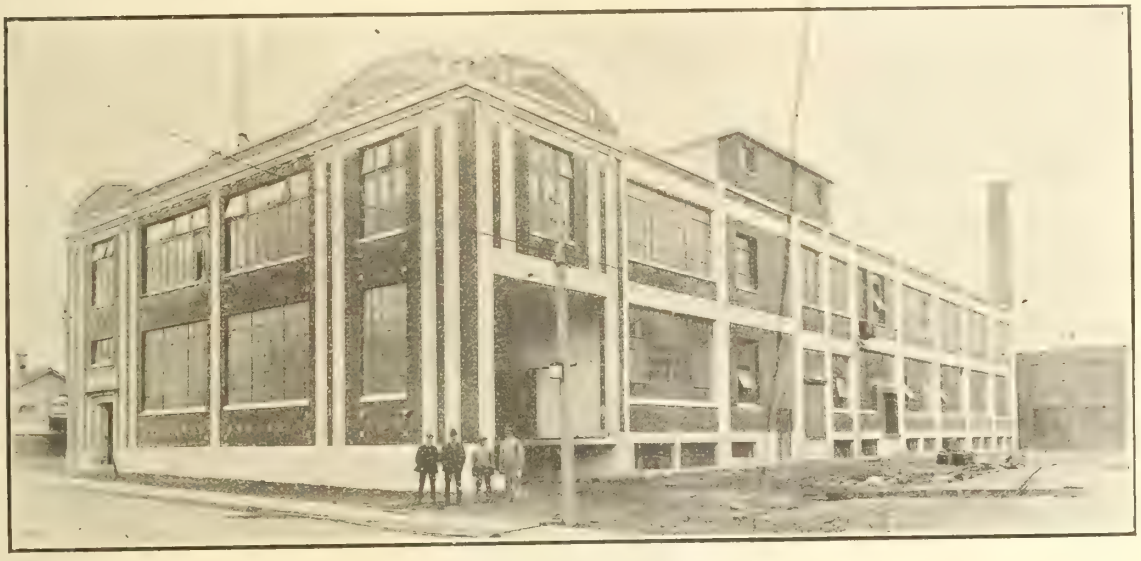
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Impregnated
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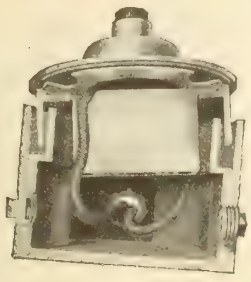


Fig. 104
Sectional view of No. 421 Outlet and No. 466 Nozzle with Bryant Receptacle No. 1363 and Plug No. 1110 mounted on lugs of Adjusting Ring.
Quarter Actual Size.

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5 No. 3AG—10 amp. 10 No. 4AG—15 amp. Total List $7.00

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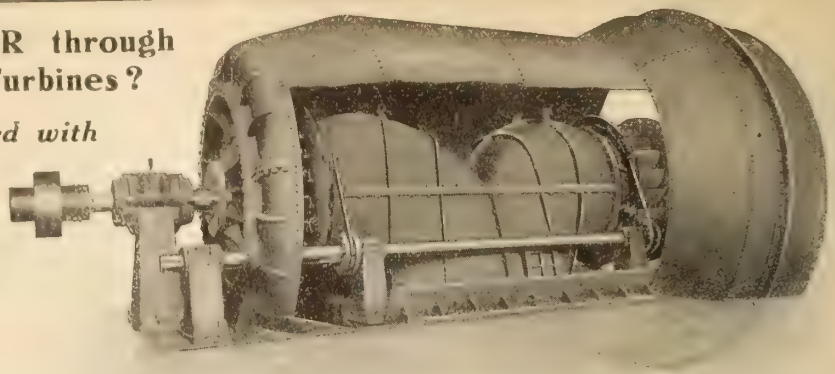
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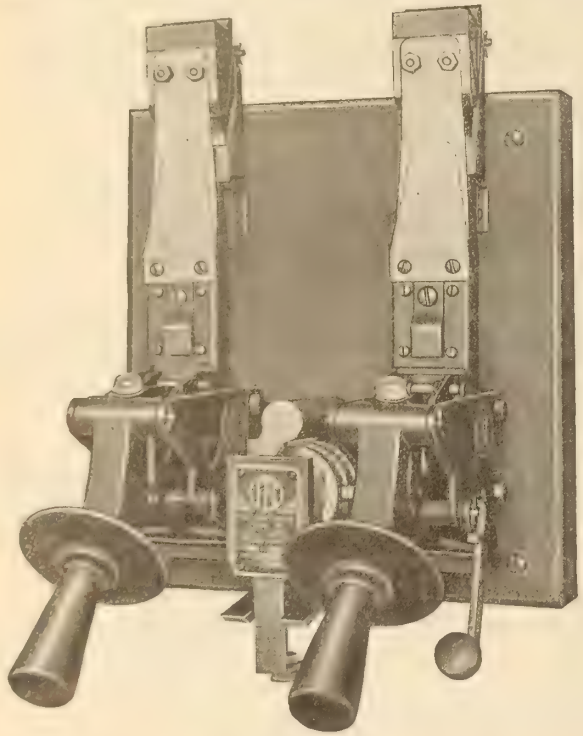
"SMITH" HYDRAULIC TURBINES

The accompanying illustration shows a horizontal shaft unit of 2000 H.P. capacity under 42' head. Write Dept. "N" for Bulletin.



S. MORGAN SMITH CO.
YORK, PA.
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BITUMINIZED FIBER CONDUIT

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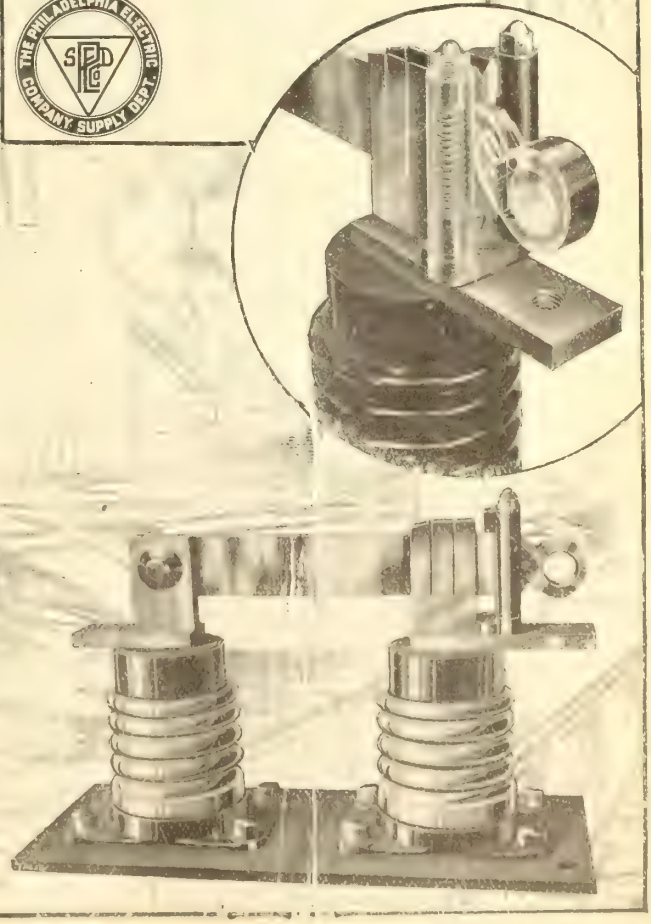
"FRANKLIN"

Disconnecting Switches, Insulators, Potheads, etc.

"Install the "FRANKLIN" and forget it."

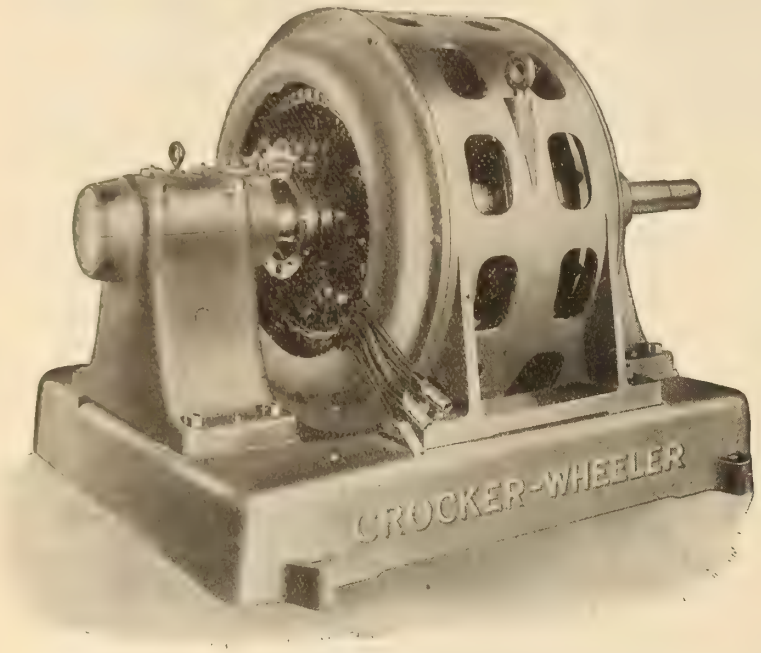
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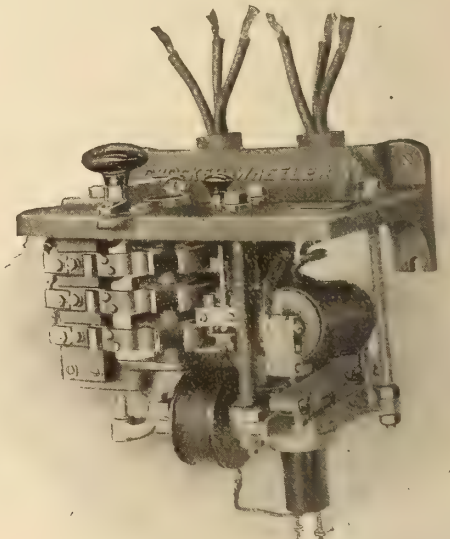
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Epecially developed for the protection of small motors under most severe operating conditions

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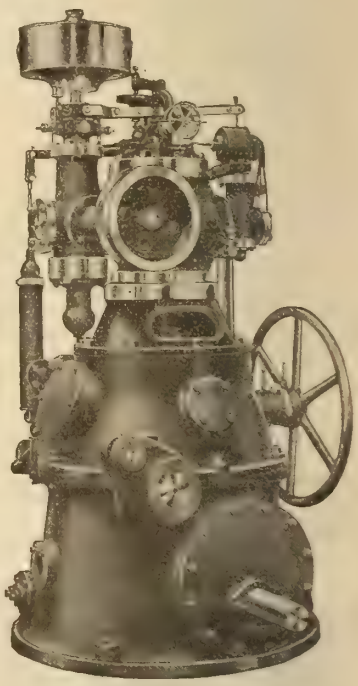
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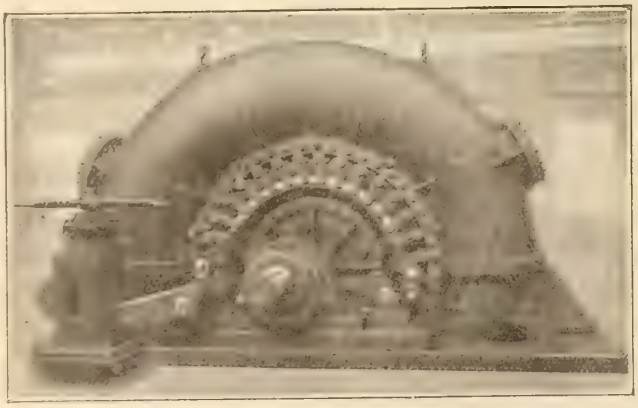
Included in the accessory hydraulic machinery which we build are Oil Pressure Governors, Pressure Regulators, Relief Valves, Hydraulic Gate Valves and Butterfly Valves.



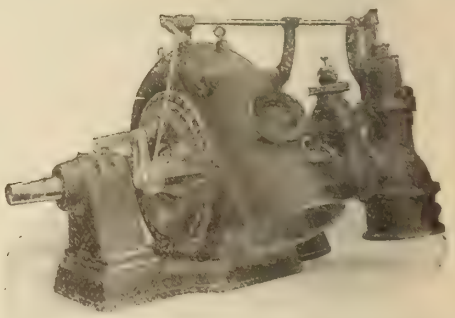
Monobloc cast iron runner for single vertical Turbine in concrete spiral casing, 6,000 h.p., 164 r.p.m., 70 ft.



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Horizontal cast iron spiral casing, single discharge Turbine, 4,000 h.p., 250 r.p.m., 264 ft., driving eight pulp grinders.



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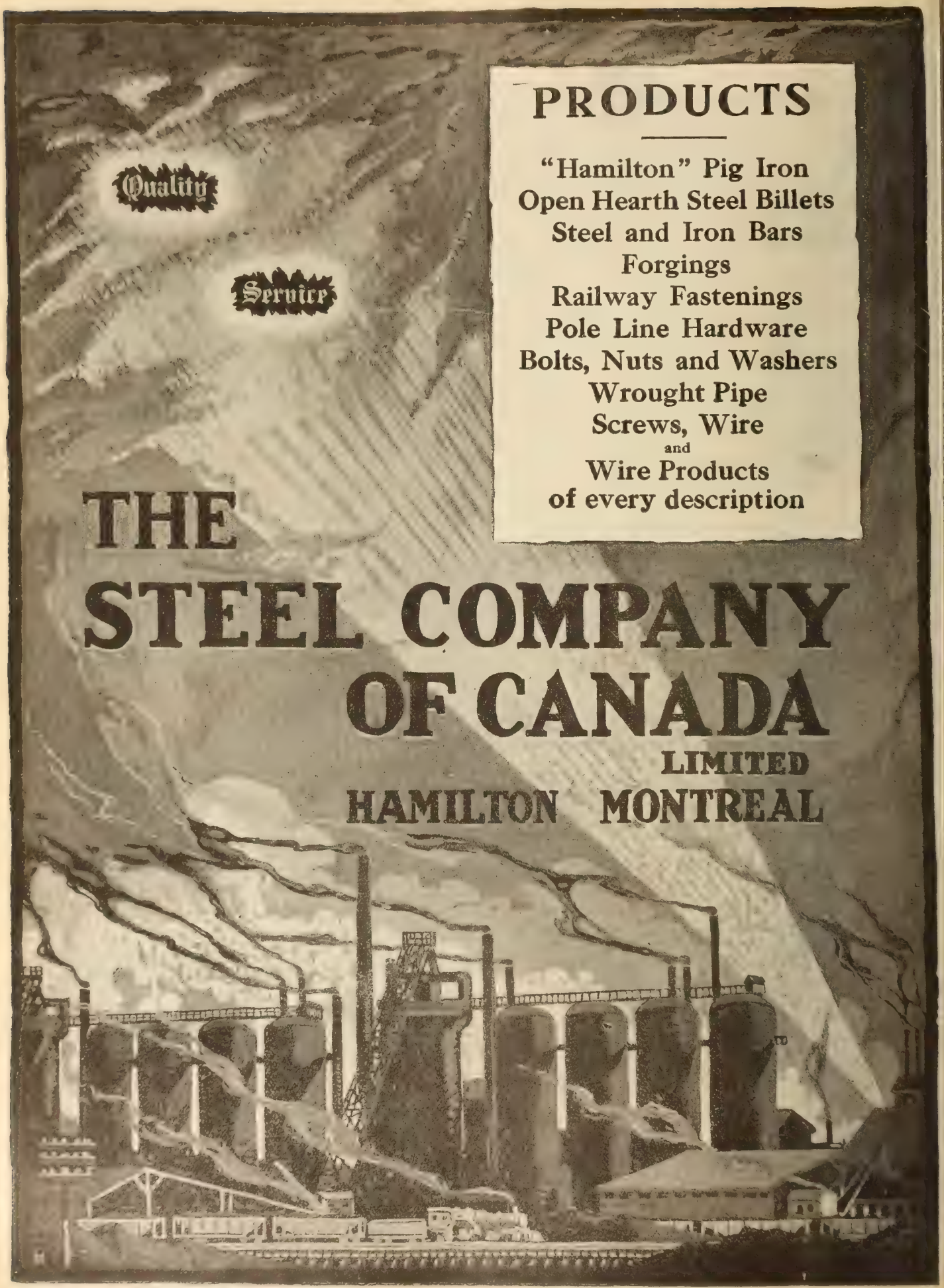
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R. & M. Type "K" Polyphase Motors with Link Belt Silent Chain Drives operating Barber-Coleman Gear Hobbers in Factory of Domestic Engineering Co.

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In the plant which is equipped throughout with the most modern machinery, where every other consideration is subordinate to efficiency and maintained production, R & M Motors win the hearty approval of factory executive.

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Distributors also find new motor prospects favorably inclined toward the R & M Motor. A decade of dominant advertising in the leading National Magazines has made R & M Quality known to nearly everyone—the new prospect as well as the experienced motor user.

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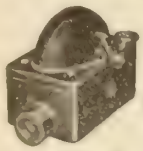
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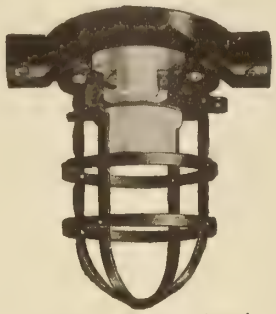
Robbins & Myers Motors

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Electric Conduit Outlet Fittings That Meet Every Marine Wiring Need.



Type ES Condulet Body With Weather Proof Cover and Glass Plate for Switches



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These Cuts Barely Suggest the Line.

Write for Catalogs and complete information



Type PHX Water-Tight Condulet



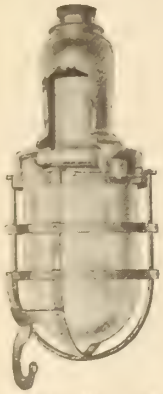
Type VJ Vapor, Gas and Dust-Proof Condulet



VIEW OF THE WAR FOX, WIRED THROUGHOUT IN CONDULETS



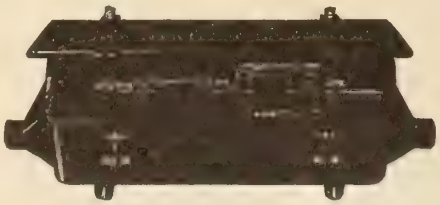
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Generation, Transmission and Application of Electricity

Published Semi-Monthly By

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Subscribers are requested to promptly notify the publishers of failure or delay in delivery of paper.

Authorized by the Postmaster General for Canada, for transmission as second class matter.

Entered as second class matter July 18th, 1914, at the Postoffice at Buffalo, N. Y., under the Act of Congress of March 3, 1879.

Vol. 27 Toronto, September 1, 1918 No 17

A 55,000 Kw. Turbo-Alternator

The first turbo-alternator of 60,000 kv.a. capacity has recently been completed in the A.E.G. works, and the following description is abstracted in "The Electrician" from "Elektrotechnische Zeitschrift." The output of the machine is 55,000 kw., at a speed of 1,000 revs. per min. It gives 7,000 volts., three-phase, with excitation at 220 volts. The turbines work at a super-heat of 326°C., and with cooling water at 27°. The weight of the turbine is 250 tons, of which the turbine rotor is responsible for 49 tons; the total weight of the alternator is 225 tons and of its rotor 106 tons. The entire weight of the machine, turbine and alternator, is thus 475 tons. The machine utilizes two condensers, each of 3,000 sq. metre superficial area, and weighing 100 tons. The outlets leading to the turbines are 2,400 mm. in diameter.

The turbine utilizes 10 radial arms of 3,400-3,800 mm. diameter. This corresponds with a peripheral speed of 180-200 metres per sec. The blades must be made of steel without any nickel content, and the arms must, therefore, be worked entire. The alternator-rotor has an outer diameter of about 2,200 mm., which corresponds with a peripheral speed of 115 meters per sec. It was not necessary to construct the rotor, which, apart from the bearing, has a total length of 9 metres, out of one single piece, but it was built up by the assembly of a large number of plates from the same metal.

The speed of rotation at which the rotor was tested in the works was 50 per cent. above working speed, i.e., 1,500 revs. per min. With single plates tests were even made made at 2,000-2,400 revs. per min. The bearings of the machine have a diameter of 600 mm., which corresponds to a peripheral speed of about 47 metres per sec. In testing the machine at 50 per cent. above working speed great pains were taken, and likewise in a prolonged test of the turbine, designed to secure that the safety-regulator on the turbine shall forbid any possible excess of speed when the machine is in continuous use.

In accordance with the standard practice of the A. E. G. the machine is provided with three bearings, the centre bearing being a double one, in view of the size of the parts. Between the two inner bearings is the flanged coupling connecting the turbine-rotor to the alternator-rotor. The turbine house has no pedestal, but rests on the bearings on either side of it. It can thus expand, unhindered, to differences in temperature. Apart from mechanical strength, the design of the whole machine was so contrived, as a result of experiments on models, to give an imposing and constructive appearance, the round form of the turbine, indicating its function, being strongly emphasized. The machine, although the first of its kind, gives an impression of complete harmony in design.

This machine, together with a second one of similar size and output, also designed by B. Goldenburg, will be installed in the Rheinisch-Westfalisches Elektricitatswerke power station, located on the site of the coal fields at the foot of the hills near Cologne. The total installation at this station (named after the designer, the "Goldenburg-works") will consist ultimately of six turbo-alternators from 15,000 k.w. each up to about 200,000 kw.

Judicious Use of Electric Heat

The announcement is now definitely made that at various points in Canada the supply of anthracite coal is certain to be less than a year ago. This is a serious situation for those areas dependent upon the United States for their fuel and suggests the advisability of electric heating wherever possible. The power shortage, which again seems inevitable, around Christmas and the New Year particularly, renders the general employment of electric heaters impossible, but their judicious and patriotic use at off-peak periods could doubtless be arranged to eke out a scanty coal supply. In general the peak load of the year, as regards electricity supply, comes on, in Canada, a month or two before the most severe weather of February, so that at least this month's coal supply, and doubtless also that of March and April, might be supplemented by a little electric heating without interference with war industries. There are also certain limited periods each day in addition to Saturday afternoon and Sundays where the maximum demand on the central station is rarely maintained.

On this supposition it would appear to be well for householders in general to equip their homes with one or two small heaters, ascertain the hours at which these may be safely used and thus make a systematic effort to get along with the smaller coal allotment.

St. Lawrence River Power Co. Demands

The St. Lawrence River Power Company is making application to be allowed to construct an ice weir in the St. Lawrence River, between the Long Sault Islands and the canal which leads to Grass River. Under ordinary circumstances thirty days' notice is necessary for the hearing of an application but, as the company urged that this work was needed to increase the output of aluminium which, in turn, was to be used for war purposes, the rules were suspended and the hearing has been fixed for August 29 in Montreal. The matter was argued at a meeting of the International

[illegible] Commission held some ten days ago at Atlantic City.

The application will, it is understood, be opposed by [illegible] interests including the Commission of Conservation unless it can be shown definitely that the scheme will not interfere in any way with the natural flow of the St. Lawrence River. An important phase of the whole question seems to be that no one had been given an opportunity to study the plans at the time of the hearing in Atlantic City, and the number of days elapsing between that and August 29 is all too short for this purpose.

Saving Power by Inter-Connection

As a solution for the reduced supply of fuel and the greater demand for power, several companies in the New England States are considering a complete inter-connection of the plants in Eastern Massachusetts. The plan under consideration would probably save in the neighborhood of 70,000 tons of coal per annum and release about 50,000 kw. generating capacity for war work. The matter is in the hands of a conference committee of central station interests headed by C. L. Edgar, president of the Edison Electric Company of Boston. Representatives of the War Industries Board, the Massachusetts Gas and Elecric Light Commission and the Conservation Division of the United States Fuel Administration, have been in conference with representatives of the central stations and all are agreed that the plan could be made effective. It is estimated that by inter-connection, the fuel consumption in the plants involved, which are about seventeen in number, would be reduced from an average of 2.38 pounds per kw.h. to 1.93 pounds per kw.h. representing a direct saving of 40,000 tons of coal. The plan does not involve the discontinuance of any of the generating plants composing the complete system. Each plant will be required to operate for a portion of each year—the most economical plants running more continually, the inefficient plants being used for peak-load requirements. The quantity of power involved is in the neighborhood of 200,000 kw. It is anticipated that the work of inter-connecting these plants will be proceeded with immediately.

Turning Scattered Prospects Into Profitable Business

Mr. S. J. Halls, sales manager of the British Columbia Electric Railway Company at Victoria, B.C., recently took advantage of the Westinghouse company's standing offer for articles for "How-I-did-it" and secured a prize for his article "Turning Scattered Prospects into Profitable Business." Mr. Halls' article has some useful suggestions and we reproduce it:

I suppose most central station salesmen or district agents have at one time or another been up against the problem of having to deal with requests for lighting extensions to streets with very few residences on them.

We had a number of such cases some short time ago in a suburban municipality.

The capital expenditure necessary in pole line construction was out of proportion to the estimated revenue from the parties desiring service, and as the premises were very scattered it looked rather hopeless at the time to meet people's wishes.

However, we naturally wanted this business, if at all possible to obtain, and therefore cast around to find ways and means of satisfying those wishing connection from our lines, and at the same time to ensure profitable business of ourselves.

The young municipality, in which these scattered homes were situated, had not up to this time seen its way clear, even on a modest scale, to embark on a street lighting scheme. Now appeared to us the opportune time to start negotiations for a system to be installed.

We accordingliy interested those parties who wanted light in their homes on the thinly settled streets, that provided satisfactory arrangements could be entered into with the council for street lightning covering the whole municipality that then sufficient revenue would be derived, in conjunction with domestic lighting, to enable us to undertake the extensions desired.

The matter soon took definite shape. I appeared before the council and explained fully the circumstances, and pointed out how by mutually getting together all parties would benefit by the proposals. I also explained the nature and operation of a street series system and submitted costs of construction and operation of such a plant.

A committee was appointed to go carefully into the question, with the result that at the next regular council meeting I was asked to draft up and submit a contract covering the scheme. This embodied that the system (excluding poles) when paid for should become the property of the municipality; that we would extend the payments over a period of some years, and also give the privilege of using our poles for such street lighting, without charge, during the life of the contract. Current was to be paid for on a kw.h. basis the municipality to maintain lamps, renewals, etc. With a few minor changes the contract was duly signed and sealed.

The factory gave prompt delivery of the necessary apparatus, this consisting of one 22 kv.a. series tungsten regulator, which, together with 190 ornamental brackets, each supporting an 80-watt, 6.6 amp. lamp on ordinary streets, and 100-watt, lamps on main thoroughfares, were duly installed within a period of three months, and lights were turned on a few days before Christmas. This was particularly pleasing to the residents, coming as it did at the festive season.

We received some bouquets for our efforts in the matter. Incidentally it also greatly assisted in returning the whole council and councillors were all re-elected for another year by acclamation, thereby saving the voters some hundreds of dollars in election expenses.

With the subsequent introduction of the street series mazda "C" lamps, we recommended their adoption, this following the use of larger wattage lamps and substantially increasing the efficiency of the system, which has since been considerably extended.

The monthly bills for energy have been kept to within reasonable limits so that the general tax rate has never exceeded a quarter of a mill on the dollar to cover the entire operation of the street lighting system—a figure, needless to say, extremely gratifying to the taxpayers.

The result of these negotiations, of course, enabled us to go ahead and connect up all our scattered prospects with domestic lighting. It was also soon noticed that there was a distinct inclination on the part of the residents of the entire neighborhood to take a renewed interest in electric lighting in their homes, to the extent that tungsten lamp sales increased very appreciably, consumers no longer being satisfied with the old carbon lamps—they wanted something on a smaller scale to give them the efficient light now to be found on their streets.

Another point of interest attached to this bit of business was its relation to our street railway business, which operates in the municipality. In the past it had been necessary for the company to supply and maintain at its own expense certain lights at prominent and dangerous crossings.

With the advent of the general series system, this was no longer necessary, as all street corners on the car lines were provided with a brilliant light, so that passengers could board or alight with perfect comfort and safety.

Within six months of the above system going into op-

eration, two other adjoining districts, not to be outdone in the matter of street lighting, completed arrangements with us for practically similar installations, carrying almost identical benefits to those recorded.

In conclusion, therefore, what looked in the first place like some scattered business hardly worth picking up, by a little judicious handling brought us three suburban street lighting contracts, added considerable load to our residential circuits, increased tungsten lamp sales, and benefited the street railway.

Merely a Typical Case

A small manufacturer of concrete mixers had a tumble-down shack in which he had been producing three and a half concrete mixers a week. The natural lighting was insufficient so that artificial lighting had to be used practically the entire day and this consisted of naked lamps of small size suspended from extension cords.

An illuminating contractor was requested to light up one-half of the shop in a better way. This he did by installing overhead units in size and number so as to give a high intensity of illumination uniformly distributed and sufficiently diffused to avoid sharp shadows. After about three weeks the owner of the plant called him up and said: "Come out and fix up the other half of the plant. Due to improved lighting, I am now making five machines a week." This, in percentage, is a tremendous gain, and as no other changes had been made in the plant, it may be attributed almost entirely to the lighting.

Typical Accidents and Fires Attributable to Electrical Abuses

"Electrical Data" for July, the official publication of the National Board of Fire Underwriters, prints a number of interesting reports of accidents and fires attributed to electrical causes. It is noticeable that any one of these accidents might have been foreseen and avoided. However, the enumeration of them is valuable as indicating the necessity for caution with even this safest source of light, heat and power. A number of typical items are enumerated below:

Bath Rooom Fixture Easily Reached by Person in Bath Tub.

In preparing to take a bath the person stood with one foot in the bath tub which contained water, the other foot being on the floor. In this position she reached over to a bowl for soap and in drawing back came in contact with a fixture with the other hand. The fixture was a one-light combination gas and electric wall bracket, which, because of broken down insulation of conductors was electrically charged. She received a shock and a slight burn on the first finger of the right hand and fell to the floor receiving injuries to the right arm, side and leg. The potential of the circuit was 113 volts.

Enters Transformer House Through Window and is Killed.

In company with other boys, a boy seventeen years of age was bathing in the tailrace adjacent to the plant of a light and power company. While playing tag, this boy climbed up an abutment and through a window into a room in the plant containing high-voltage transformers. The boy's brother looked in at the window and noting that something was wrong, hurried to the engineer. From the marks upon the body it was apparent that the victim's head came in contact with the high-voltage wires. The transformer room was kept locked and the window was left open for ventilating purposes.

Taking Electric Iron Into Bath Tub.

The victim, aged 34, of this accident entered the bath room taking along an ordinary six-pound electric pressing iron. The iron he attached by the usual cord and plug to a lighting fixture. After filling the tub with water he stepped in, taking the iron with him. He received a shock, the cord and iron became water soaked and the victim called for help. Before the current could be shut off he was found to be dead.

The lighting system was 110-volt, alternating current with the secondary neutral permanently grounded, allowing no possibility for a higher voltage to ground. The lighting bracket was found bent down, due to efforts to pull the cord loose from the fixture, and the heating element of the iron was found to be burned out.

Boy Climbs High-Tension Wire Tower.

Three boys were playing at the foot of a tower supporting high-tension wires. One of the boys proposed a game of "stump the leader." At this, one of the boys climbed to the top of the tower, touched one of the wires and fell 40 ft. to the ground, dying from shock and burns.

Arc Lamp Supporting Chain Charged.

Two men in a buggy came to a railroad crossing. One of them alighted and approached the track to see if a train were coming. Placing a cigarette in his mouth, he walked over to a wooden pole at the crossing on which electric light wires were strung, reached out to scratch a match and at the same time touched a chain used in lowering and raising the arc lamp, also supported by the pole. The chain was charged and the man was killed.

Fire in Bedroom Started by Electric Iron.

An electric iron was used as a massage instrument and kept in the bedroom. The occupant neglected to disconnect the plug from the wall receptacle or from the iron, with the result that the bed and contents of the room were considerably damaged by fire.

Tenant Replaces Heating Cord with Ordinary Lamp Cord.

An electric pressing iron was properly installed with standard heater cord between the socket and iron. The cord becoming worn, the tenant of the building replaced the worn cord with ordinary lamp cord which soon short-circuited, causing a fire.

Electric Iron on Lighting Circuit.

An electric iron was disconnected by a wall switch, which also controlled the lighting of the room. The current had been turned off the iron at the switch, but a person coming into the room, turned the switch on and obtained no light because the lights were turned off at the socket. He neglected turning the switch to the "off" position.

Pennies Replace Blown Fuses

The key socket on a pendant cord became short-circuited because socket screws were not tightly set in place. The short-circuit burned along the pendant cord to a rosette and the burned cord and socket dropped to the floor. Upon investigation as to why the fuses on the circuit had not blown out, it was found that a few days before, the owner had had trouble with this circuit and 6-ampere fuses had blown. A workman from a local factory, called saying he would remedy the trouble, which he did by placing a penny back of each fuse.

Poor Connection of Attachment Plug to Cord.

Poor workmanship in connecting a cord to an attachment plug caused an arc which set fire to the insulation of the cord. The cord ran through decorations in a show window and the flame was carried to this point.

Lamp Cord Hung on Nail Over an Open Oil Barrel.

In an automobile garage a common lamp cord, somewhat worn, was hung on a nail. Just below this was an open oil barrel. Weak insulation, the nail assisting, caused an arc to be formed and pieces of the burning cord fell into the oil

burned, from which the fire communicated to the surrounding timbers.

Staple Cuts Through Lamp Cord Insulation.

Ordinary lamp cord was extended, for branch lighting purposes around the baseboard of a room and held in place by metal staples. A staple cut through the insulation of the cord and started a fire.

No. 18 Telephone Wire Used to Connect Porch Light

A No. 18 telephone wire was used to connect from a branch block to a receptacle for a light on the rear porch of a residence. The wire became short-circuited, seting fire to the weather-boarding.

Window Curtain in Contact with Incandescent Lamp Globe.

A tapestry window curtain was draped so as to be in contact with one of the lamps of a candelabra bracket fixture. The heat of the lamp ignited the curtain.

Hot Lamp Globe Causes $10,000 Fire.

A department store had woolen blankets stored in small bales. These were stacked on high shelving, and in moving the stock about a common lamp cord was used as a portable lead to an incandescent lamp. The cord was left lying in contact with and between the bales of blanets. To the cord was attached a lamp without a guard. The lamp was left in contact with the blankets, and a fire loss of $10,000 resulted.

Incandescent Lamp Used as a Clothes Hook.

A sixteen candlepower carbon lamp in a wall receptacle was used as a hook for clothing. The occupants of the building returning late in the evening found the rooms filled with smoke and the walls and floor somewhat burned.

Report on One-man Cars by the A. E. R. A. War Board Confirms its Superiority

The War Board of the American Electric Railway Association has submitted to the National War Labor Board a report on the development of modern one-man cars. The following has been abstracted from this report by Electric Traction:

The need of one-man cars has been brought about by the enormous increase in all operating costs and by the scarcity of platform labor, owing to the large number of men who have gone into the war or war industries. The average operating ratio has risen from 50 per cent. in 1912 to 72 per cent. in February, 1918.

It is estimated that 30,000 of these cars could be used advantageously. There have been built, however, only about 700 one-man cars of a modern approved type. The old shuttle car with the closed rear platform is a common type of the one-man car. The use of cars of this type is limited to minor service. For complete routes with light traffic a better type of car is usually employed. The equipment of these cars is also more complete and more modern, including mechanically operated devices and air brakes. Probably the most advantageous use of the one-man car is in congested districts of the larger cities where the limited service is sufficient to handle the traffic. Such use has proved feasible in cities of from 50,000 to 400,000 population.

The type of one-man car, suitable for this purpose, will seat about 35 passengers. By supplying about 50 per cent. more cars of this type, it is estimated that more seats will be provided for passengers with only about two-thirds of the usual number of platform men. The reduction in the weight of the cars displaced will, it is estimated, reduce the fuel consumption an amount proportionate to the reduction in weight. The one-man car is estimated at less than 400 lbs. per seat, while the cars displaced weigh from 700 to 1,200 lbs.

The safety equipment is defined as a combination of air brakes, air operated doors, air sanders and the deadman's handle of the electric controller. This equipment automatically insures, first: That the doors will not open until the car has come to a full stop. Second: That the car will not start until the doors are closed. Third: The power will go off, the brakes will apply instantaneously and the track will sand, the moment the operator of a moving car fails to bear down on the controller handle of the deadman type.

The saving in manual labor is, of course, considerable. Under certain assumed conditions of normal traffic, 1,140 door operations are required in 10 hours. Automatic doors alone, therefore save considerable labor. The saving in labor with air brake equipment is apparent. The number of movements saved in eliminating the starting and stopping bell-signal is enormous and worthy of saving both as to time and to labor, as is also the fare registering labor.

The best proof that "safety" cars need only one man is presented by the fact that nearly always these cars are making better, faster schedules than the two-men cars, which they replace. If the one-man car was appreciably slower, the railways would abandon its use, because of the loss in mileage, the slowing up of the service and the increased liability of congestion would wipe out any saving due to a smaller crew.

The superiority of the "safety" car is confirmed for a wide range of service by data included in the report, covering 10 cities ranging in population from 21,000 to 400,000. These figures should prove conclusively that one-man safety cars are amply able to meet a wide range of operating conditions, and that if they were applied wherever possible, there would be a saving of hundreds of thousands of tons of coal annually and a saving of several thousands of men.

From the figures and data included in the report, the following points are brought out: (1) That the one-man safety car is applicable to a wide range of electric railway conditions. (2) That the safety cars of new contsruction permit of enormous savings in fuel. (3) That all safety cars permit greatly increased service to the public while still permitting a large reduction in platform personnel. (4) That the safety car, because of the use of automatic devices, can be operated at a higher schedule speed by one man than an older style car can be operated by two men. (5) That the safety car fully justifies its name as the preventer of accidents through the inter-operation of control, brakes, doors, steps, sander and emergency brake. (6) That only the safety car's economies in operation and improvements in service have made it financially practicable to maintain railway service in small cities where short headways were a necessity and in larger cities where the shortage of labor has seriously impaired the ability to give adequate service even with but one man per car, as at Seattle and Tacoma. (7) That the safety car is preferred by the men themselves because it eliminates all manual labor and avoids division of responsibility with a second platform man. (8) That the safety car promotes better public relations in demonstrating the goodwill of the railway, thereby paving the way for a solution of the local utility problems. The modern one-man car now costs about $6,700.

In conclusion, it is pointed out that the rate of change or turnover of platform men is so great that no man has ever been deprived of work on the properties named, because of the introduction of the one-man car. The railways hope in fact that the elimination of manual labor on these cars will enable them to offer employment to a wider classification of men and to keep such men longer in the service.

Pay-as-you-enter cars are being installed on some of the lines of the Hamilton, Ont., street railway.

The Economic Electric and Manufacturing Company, Montreal, have registered.

Aerial Cable Construction for Electric Power Transmission

By E. B. Meyer*

Central station companies have had to meet a number of difficult problems during the past three years but the most important has been that of supplying enormous power demands imposed upon them. On account of the rapidity with which most of the materials covered by war contracts must be delivered, industrial companies found that the building of isolated plants was out of the question, not only because of the time necessary for erection, but because of the low rates and excellent service furnished by utility companies.

At the present time the central station engineer in dealing with the customer has to provide for thousands of kilowatts rather than hundreds, which were the usual demands

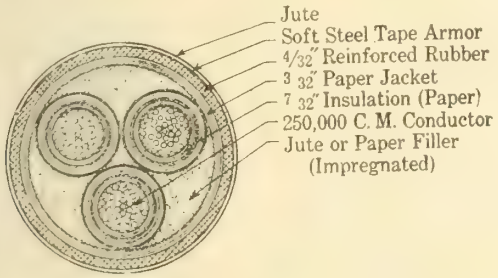


Fig. 1—Reinforced rubber-covered aerial cable.

previous to the war. These large demands have made it necessary to solve numerous operating problems in connection with the transmission system and to devise special methods of construction in order to serve the industries upon which the government is depending to help win the war.

The Public Service Electric Company, which operates in 200 municipalities throughout the State of New Jersey, supplies light and power to approximately 170 manufacturing plants engaged directly or indirectly on Government contracts. One of the special methods adopted by the Public Service Electric Company in meeting war time demands, was that of furnishing the customer with primary service by the use of aerial cable run on poles and supported by messenger wire, a type of construction similar to that used in telephone work. This type of construction was first used by the company about seven years ago when it was found necessary to connect two large generating stations through tie feeders.

The matter of running overhead wire was considered but found impracticable because the line in several places would have to cross freight yards, trestles, and bridges, and the owners of these structures objected to open-wire high-tension lines. Most of the section between these two stations was soil of a marshy character, through which it would have been impossible to run a duct line without the use of foundation piling. It was therefore concluded that the use of aerial cable furnished the most satisfactory solution of the problem. In this installation ordinary lead-covered cable of the same type as that for underground work was run on a pole line with 50-ft. pole spacing. To protect the sheath from mechanical injury there was applied a covering consisting of several layers of jute and marlin with an outer armor of soft steel tape.

Special Cable Designed.

The use of lead-covered cable for aerial work was found undesirable, however, because of the excessive weight of the cable and the fact that it could not be installed on standard pole line construction, and a special form of cable was developed to overcome these objections.

In Fig. 1 is shown the modified form of cable for 13,200-volt operation, which is made up with 7/32-in. paper conductor insulation, a 3/32-in. paper jacket and a 4/32-in. reinforced rubber covering over the paper jacket. The reinforced rubber covering is similar in construction to that of the ordinary garden hose, being made up of several piles of fabric and rubber. The entire cable is saturated with rubber compound and covered with tape and a weather-proof braid, thoroughly impregnated with a waterproofing compound. For mechanical protection, the whole core is encased in an armor made up of galvanized steel tape. The use of this form of construction reduces the weight of the cable approximately 50 per cent and permits the use of lighter pole line construction.

The process of manufacture of the reinforced rubber covering consists in calendering both sides of the cotton fabric, previously dried and waterproofed, with a 30 per cent Para rubber compound, so as to obtain a thorough filling of rubber, which, under the process of calendering, becomes partially vulcanized. The prepared fabric is then cut into tapes. These are applied to the electrical conductor in the usual manner, all contact surfaces and interstices being filled with a rubber cement. The insulated conductor is then dried under moderate heat. According to whether the reinforced rubber covering is applied over an insulating layer of rubber compound, or a layer of cambric or paper, the finished cable may or may not be subjected to vulcanization. In the latter case, the partial vulcanization of the rubber in the reinforced rubber is further advanced during the drying process and

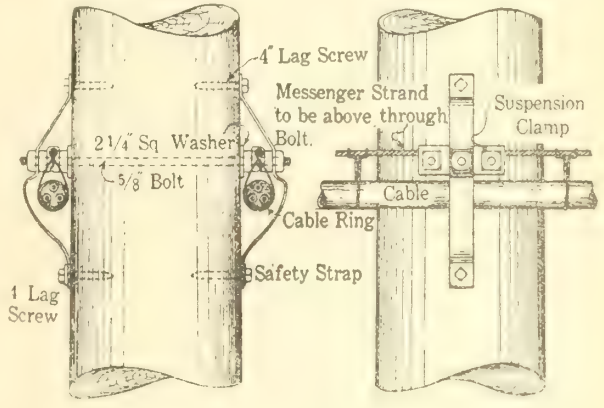


Fig. 2—Method of suspending messenger cable.

during leading in the case of leaded cables; otherwise further vulcanization takes place with aging and under service.

The finished material is perfectly homogeneous. Its specific insulating and dielectric constants are lower than those of rubber, paper and varnished cambric insulation, and for that reason, among others, it is preferable to combine a thickness of reinforced rubber with one of the other materials. By placing the reinforced rubber outside a thickness of a higher dielectric compound near the copper wire, the potential gradient is reduced so that the lower dielectric compound near the copper wire, the potential gradient is reduced so that the lower dielectric strength of the reinforced

* Before the A. I. E. E.

does not materially decrease the total dielectric strength of the cable.

Many engineers have been of the opinion that paper insulated cable with the reinforced rubber jacket would not give satisfactory service when subjected to the heat of the summer sun, but in spite of the fact that the cable is exposed to the elements throughout the year the Public Service Electric Company has never experienced a service interruption through the failure of any of the aerial cable in use in the transmission system.

The following table gives approximate weights and outside diameters of three conductor cables, insulated for 13,200 volt operation:

Approximate Weight and Diameter of Three-Conductor, 13,200 Volt Aerial Cable.

Size	Weight per foot pounds	Diameter Inches
No. 4	3.50	2.25
No. 2	4.05	2.41
No. 1	4.45	2.50
1/0	4.80	2.57
2/0	5.70	2.66
4/0	6.70	2.91
250,000 cm.	7.05	3.00
350,000 cm.	8.50	3.22

The principal advantage of aerial cable for tie feeder installations is that it makes little difference how many working lines are carried on a single pole line. Additional cable may be run, existing construction changed, transferred or repaired without taking out of service any line except the one on which the actual work is being done. Lightning discharges seem to have little effect because the messenger wire which carries the aerial cable is permanently grounded.

The usual aerial cable installation requires the use of Class B chestnut poles, with a normal spacing of from 90 to 100 ft. Where conditions make it necessary, sections as long as 150 feet are permissible, but in such cases the adjacent sections should not exceed 130 ft. Sections longer than 150 ft. should receive special attention, and Class A poles should be used on long sections and at points of special strain. The location and frequency of guys is largely dependent on local conditions and can, in most cases, be decided upon by a competent line superintendent.

Attention is called, however, to the fact that the stress at dead ends and corners is very great, frequently being as much as 25,000 lb. These points of special stress need to be well guyed. Both the anchors and the guys should be designed with a factor of safety so high that the messenger will fail before the pole will pull over. In all cases it will be necessary for guy stubs to be reinforced by an anchor guy.

For the suspension of the messenger a double ended 5/8-in. through bolt is recommended, as illustrated in Fig. 2. The use of a safety clamp is also desirable. This clamp serves the double purpose of reinforcing the through bolt and preventing the cable from falling to the ground in case the rings fail. Careful tests made on the method of suspension show that it will withstand the maximum loads to which it will be subjected.

The type of clamp used is similar to that used by the American Telephone and Telegraph Company, the size depending on the diameter of the messenger strand adopted. The clamp is designed expressly for construction of this character and is not built like a guy clamp which is designed to grip two strands instead of one. It affords a greater lever arm for the bolts to work upon in grasping the messenger and supports the messenger strand closer to the bolt, decreasing the bending moment on the bolt due to the weight of the cable.

The messenger strand should always be placed above the bolt in order that the weight of the cable will not be supported by the clamp. Various forms of cable rings may be used in supporting the cable on the messenger wire.

Where one or more cables are to be installed on a pole line they are usually in pairs, two from each through bolt. The messenger wire is extra strength 5/8-in., seven-strand, galvanized, steel wire. The wire composing the strand should be free from scale, inequalities, splints or other imperfections, not consistent with the best workmanship. It is usual in purchasing galvanized steel wire of this character to have it conform to a specification covering the galvanizing. This is necessary as otherwise inferior grade wire might be obtained.

Messenger Should be Drawn Tight.

It is very important that the messenger wire be drawn as tight as possible, in order to prevent sagging when subected to the weight of the transmission cable. If this is not done, an unsightly installation will result. After the messenger wire has been given its final pull and properly dead-ended, the placing of the aerial cable in the next step. In pulling the cable up to the messenger wire it is very important that precautions be exercised to prevent mechanical damage or excessive strains which would tend to weaken or damage the insulation.

It is customary in aerial installations to ground the messenger strand. Where the soil is dry or soil conditions unfavorable for grounding, a ground connection should be installed at every second pole. Where the earth is damp and soil conditions are favorable, a ground should be installed at every fourth pole. In marshy ground and in places where conditions are particularly favorable, a ground at every eighth pole will be sufficient. Where possible, this ground connection should be well bonded to some metallic subsurface structure. If this is not possible, the standard artificial pipe ground should be installed.

It is also desirable that the steel tape on the cable be banded to the messenger strand with bonding wire at every cable joint, as proper bonding is necessary in order to furnish the required protection against lightning. Where cable is run through trees and likely to be damaged by abrasion it should be protected by several layers of galvanized tape similar to that later described for use in protecting the joint.

In Fig. 3 is illustrated a method of clamping the cable to the messenger wire. On steep grades where the angle between the cable and the horizontal is greater than 30 deg. the use of such a cable clamp is recommended. This clamp can be made up as required and should be used on every fourth pole. It is designed to take the greater portion of the down hill pull on the cable, which otherwise would be carried by the cable rings.

In erecting the cable, the first reel is set up in the usual manner and the cable run off to the first pole, at which is placed a sheave of approximately 12 in. diameter, the top of the sheave being located about 5 in. below the messenger wire. On the four or five succeeding poles similar sheaves or cable rollers are placed, and in feeding out the cable 2.5-in. (6.35 cm.) "S" hooks, spaced 18 in. (45.6 cm.) apart, are fastened to it. These hooks are fastened to the cable with a small piece of marlin, made up in a loop knot, as illustrated in Fig. 4.

A line man is stationed at each pole to change the "S" hooks from one side of the pole to the other, which process is repeated until the entire length of cable has been installed in place.

The "S" hooks, which were used as a temporary support, are now removed and permanent rings put in place. This is done by a lineman supported on a boatswain's chair, which

is moved along the section supported by the messenger wire.

In running the transmission cable, either a motor truck, horses, hand or power winch may be used.

In the splicing of aerial cable, no special means are employed, but the usual precautions observed in the installation of underground cable must be followed. The jointing of any cable is more or less a matter of individual experience and great care must be exercised in all cases to exclude moisture. The work should be carefully done by a reliable and experienced workman and no splicing should be undertaken when weather conditions are unfavorable.

Each conductor of the cable is insulated with black bias-cut varnished cambric tape of a thickness of about 30 per cent. greater than the machine applied insulation. Between each layer of tape, varnished cambric insulating compound is applied. After the individual conductors have been insulated a jacket of bias-cut black cambric tape, well painted between layers with an insulating compound, is applied to a thickness of 4/32 in. Over the jacket of cambric tape several layers of the best grade rubber tape, 5/32 in. in thickness, are applied and painted between layers with a high-grade rubber compound. The completed joint is then covered with three or four layers of friction tape well painted with rubber compound. The joint is then ready for the application of a soft steel galvanized tape over which is finally applied an outer covering consisting of three or four layers of friction tape painted between the layers with a good grade of waterproof compound.

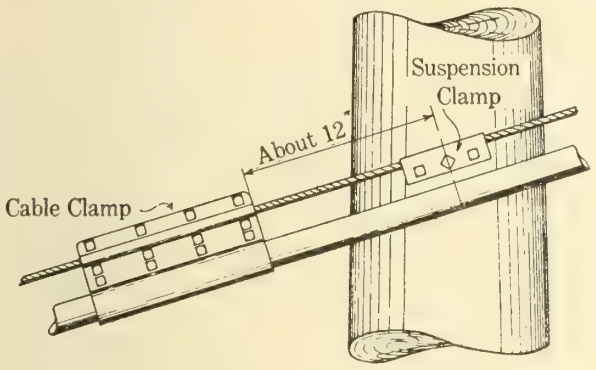


Fig. 3—Clamping cable to messenger on grade.

Where it is necessary to make connection from an aerial cable to an underground system a standard form of lead covered cable is used and installed in a lateral pipe. The joint between the underground and aerial cable is made up in the manner just described, and there is slipped over the joint a lead sleeve, one end of which is wiped to the lead-covered cable. The other end is well taped to prevent moisture from penetrating the cable.

While most of the existing circuits are operated at voltages under 15,000, the excellent results obtained with aerial cable has led the company to use this type of construction on all special work for operation at 26,000 volts.

To keep the cable in good condition it is necessary to paint it every four or five years with some form of insulating paint. This serves to keep the outside jacket from disintegrating and protects it from the action of the elements.

There is in service in the various transmission lines of the company approximately 65,000 ft. of aerial cable operating at 13,200 volts and about 16,000 ft. either operating or in course of construction for 20,400-volt service.

It was impossible within this short length of time to obtain the standard aerial cable with reinforced rubber insulation, and it was found necessary to take ordinary lead covered cable out of stock.

The erection of lead covered cable by the methods commonly used in installing aerial cable, on account of the weight and long pole spacing, would have resulted in throwing too great a stress on the messenger wire and lead cable. It was, therefore, decided to use the catenary form of construction so as to reduce the strain, with the result that the transmission cable hangs perfectly level and without sag.

Aerial cable construction is somewhat more expensive than ordinary open wire construction, but its cost is less than that of an underground conduit system. As the costs of the various types are so largely dependent on local conditions, no comparative estimates will be given here. In general, the cost of an aerial cable is about midway underground and open wire construction.

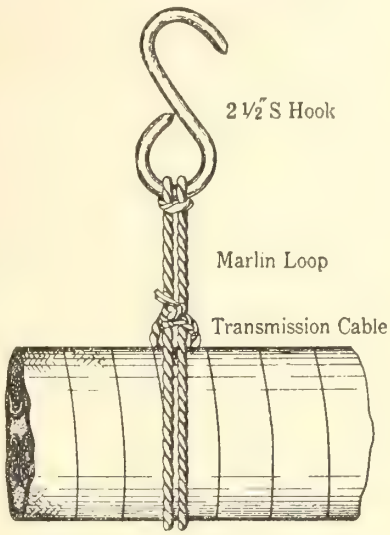
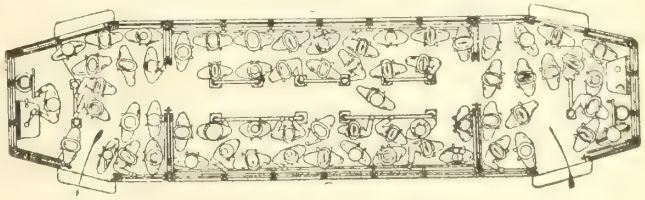


Fig. 4—Method of fastening hooks to aerial cable.

While this paper deals primarily with the use of reinforced rubber cables, there are numerous installations throughout the country where other forms of insulation have been used with satisfactory results.

Seatless Car Being Tried in Rome

On some of its routes the Rome (Italy) Tramways is experimenting with a number of seatless motor and trailer single-truck cars. These cars, as shown by the accompanying loading diagram, reproduced from the Electric Railway Journal, are of the inclosed type with bowed ends, and they accommodate as many as sixty-five passengers.



A seat-less car for rush hours.

Passengers enter at the rear and leave at the front, both on the near side. The rear platform accommodates seventeen persons, and the front one only thirteen, a space being chained off for the motorman. In the body of the car, separated by a series of hand rails, are three parrallel longitudinal aisles. The centre one is kept free for fare collection and passenger circulation.

The new cars are clearly marked on the vestibules at each end: "Standing Places Only." The company plans to try them for six months and watch the economic and social results. If there is no serious objection, the public authorities will permit the continuance of the seatless-car service and its extension as traffic demands require.

The Engineer's Opportunity—Present and Future

Just as the engineer has demonstrated his value in war time so, after the war, he will be one of the most important factors in the unprecedented race and development which most men believe inevitable. It behooves engineers in general then, to realize their importance and prepare for the days to come. Quite an interesting address along this line was recently delivered by Mr. S. A. Redding, superintendent of the local railway and power company before the student branch A. I. E. E., in the Georgia School of Technology. Some abstracts follow:

Judging from conditions as they exist in the world to-day, it requires only ordinary intelligence to comprehend in a general way what the future holds in store for the engineering profession, and particularly the younger engineers who are just starting out in business and have not fully made up their minds just what line of work to follow.

There never was a time in history when the engineer was in such demand as he is to-day, and will continue to be for many years to come.

When we stop to consider the enormous loss of life which has already occurred, and the additional loss which, unforately, is sure to follow; when we try to realize the almost inconceivable amount of property damage and destruction which has been wrought throughout Europe and on the high seas; and when we think of the enormous amounts of foodstuffs, munitions, machinery, and supplies of all kinds that are absolutely necessary in carrying on a struggle of such magnitude, it can be readily understood why young men are destined to take such a conspicuous part in the affairs of the world in the near future.

The value of any commodity is based on the law of supply and demand, and with the supply limited and the demand practically unlimited, the values of commodities are bound to be high. This law applies equally well to manual labor and all other forms of human effort; this being true, think of the enormous amount of reconstruction which will have to be done—reconstruction of work representing many years of hard labor and fabulous sums of money—railroads, bridges, highways, industrial plants of all kinds, and even entire cities in the boundaries of which are included every kind of construction imaginable; then, on the other hand, consider the available supply of raw material, the limited manufacturing facilities, the shortage of man power—skilled mechanics and artisans of all kinds as well as common labor —and you will readily conclude that it will be difficult to overrate the importance of the engineering profession when peace finally comes

Work Will be Plentiful.

Every branch of the engineering profession will be overrun with work, and while, from a purely money-making standpoint, there should be little to choose between the different branches, it is evident that one will most likely meet with the greatest measure of success by following the line of work in which he has the most decided talent.

The electrical and mechanical engineering fields will be very productive; the hydraulic and civil engineers will have their hands full; and the architect and textile engineer will also be in great demand.

From July 1914, when the war broke out, until we were finally forced to take a hand, the many electrical and mechanical manufacturing industries in the United States had been gradually changing over their existing plants and making new additions in order to take care of the requirements of the allies, but since our entry the requirements of our own governmetnt have been so great and so urgent that practically every manufacturing concern in the country has been loaded beyond its capacity with government orders of all kinds.

As a result of these emergency conditions, it is practically impossible for public utilities such as the telephone, electric light, power, street railway, and gas companies to secure promises of deliveries on equipment requirements in better than nine to twelve months, except where it can be conclusively shown that the equipment or material required is to be used in actual government production; and, on certain kinds of apparatus, quotations cannot be obtained at all. Furthermore, on account of the unsettled financial condition of the world since the war began, a great many of the public utility companies have been forced to steer close to shore in order to avoid financial disaster. The purchasing of much needed equipment has been held off just as long as possible in the hope that the war would end in a short while; and so, when it does finally end, there is going to be a big commercial drive which will tax the capacity of the manufacturing forces to the limit.

Since many of the manufacturing concerns have had to change over equipment and plant arrangements in order properly to handle the Government war orders, it will be necessary for them to undergo a second transformation in order efficiently and promptly to meet the needs of the public utility companies, the steam and electric railroads, and the thousands of other industrial enterprises in the United States and neutral countries, in addition to the urgent needs of the devastated countries of Europe. One might well hazard the guess that depreciation and the wear and tear on railway lines and rolling stock, and on the machinery and equipment, running continuously day and night, during the past three and a half years, in feverish efforts to keep pace with the needs of war, will far exceed in money value the actual destruction caused by the war itself, great as this amount must be.

The serious coal shortage which was experienced last winter, while due to a combination of unusual circumstances, was a near national calamity which our Government will not allow to recur if possible. Certain phases of a similar situation in the future can, of course, be obviated by storing up coal during the summer months; but while such a precautionary measure would take care of domestic requirements, some other means will have to be devised to safeguard the cities and communities dependent upon the steam central-station and the gas plant for their electric light, power, and fuel for manufacturing as well as domestic needs.

The Government, as well as the central-station management and the manufacturer very clearly see the urgent necessity for immediate action to relieve the situation permanently.

The Need for Water Power Development

The plan, which would be productive of the greatest relief in the shortest time, includes the general development of the numerous water-powers throughout the United States. The electric energy thus generated would be transmitted at high voltages to the cities, towns, and rural communities within a radius of 25 to 150 miles, the distance depending in large measure on the size of the development.

This plan of general water-power development, will, when put into effect, give great impetus to the movement already under way for a more general electrification of the great trunk lines all over the country. It is a well-known

fact that the steam locomotive is one of the most uneconomical types of steam apparatus in use, consuming about six pounds of coal per horse-power-hour as compared with the modern steam turbine which consumes less than one-third this amount.

In those sections of the country not favored with water powers, coal will continue to be the source of power; but it is quite probable that considerable attention and study will be given to the comparatively new practice of building the steam station at the mouth of the mine and transmitting the converted energy over high-tension lines to the centres of distribution, instead of hauling the equivalent amount of coal to the steam stations located in the cities and towns and other points remote from the mine. This scheme would release still more cars which would be available for the transportation of other commodities which, unlike coal, cannot be transformed and transmitted direct to their destinations. With the principal water-powers developed; with modern steam stations built at the mines throughout the country; with a large proportion of the trunk lines electrified; and with large government controlled coal depositories in every city throughout the country, filled during periods of light traffic, the solutions of the coal and transportation problems will be found.

Now, what has been said applies not only to our own country and the allies, but to practically every neutral country throughout the world; for while no single nation at war has supplied all the manufactured exports to all of these neutral countries, all of the belligerents together have, in the past, supplied practically all of the machinery and manufactured goods of all kinds, used by all of these neutrals. Surely, if we, right here in the heart of the industrial world, have been unable to secure much needed equipment, it does not stand to reason that the neutral countries have been able to do so. The probabilities are that they are as bad if not worse off than we are, so when the great struggle is over, Brazil, Argentina, Chile, Peru, Bolivia, and the smaller republics of South and Central America, and Spain, the only country of any size in Europe not participating in the war, will be pleading, along with the rest of the world, for machinery of all kinds and the engineers and skilled mechanics to make the installations.

The Use of High-Pressure and High-Temperature Steam in Large Power Stations*

By J. H. Shaw

THERE is little doubt that the majority of power station engineers have given attention to the efficient utilisation of steam at the lower ranges of temperature and pressure, and have been during the past few years considering the upper range. Here there is rather more scope for choice, but it appears that doubt exists as to whether it is the more economical to increase the temperature of the steam by superheating or to increase the range by the use of higher pressures and a moderate amount of superheat. This question has been shelved to a certain extent, owing to engineers being engaged on war work, and thus unable to give the necessary time and attention to developing plant suitable for the higher ranges.

An interesting plant has been installed by the British Thomson-Houston Company at their Rugby power-house, consisting of a B.T.H. turbine and a Babcock and Wilcox marine type boiler, capable of a normal evaporation of 18,000 lb. per hour with feed-water at 80 deg. Fah.—the working pressure being 350 lb. per square inch, the final temperature of the steam after passing the superheater 700 deg. Fah., and the test pressure of the boiler 525 lb. per square inch. Good results have been obtained from the combination, and an inspection of the machine after about a year's operation showed no undue signs of wear.

At the Carville power station, Newcastle-on-Tyne, the latest section of the boiler-house is designed for 275 lb. pressure, and at Glasgow the boiler pressure at the new works is to be 250 lb. per square inch.

Does It Pay?

A question that will appeal to all is "Will it pay?"

A good case can be made out for a jump to 600 lb. pressure with a total temperature of 700 deg. to 800 deg. Fah., but this will involve a considerable amount of development charges being borne by the undertaking or undertakings which are the first to adopt such a pressure. On the other hand, it appears that practically all designs of existing apparatus can be so modified as to admit of pressures of 350 lb. to 400 lb. per square inch. It would, therefore, seem that to increase the working range of steam without the development of new designs a pressure of 350 lb. can safely be adopted, and that if it is decided to increase the range the adoption of a pressure below this is akin to "hedging" the question.

When considering any results of tests on high-pressure or high-temperature steam generating plant, it is essential that the tests on the boiler side and the tests on the turbine side be studied separately; further, it must be remembered that any results obtained on an extra high-pressure boiler can be obtained, and considering the boiler apart from the economiser, surpassed on a similar and similarly equipped low-pressure boiler.

For a comparison between the cost of running a power station at 200 lb. pressure (gauge) and at a 350 lb. pressure, a schedule has been prepared. It is proposed to consider a riverside station, where the water is suitable for surface condensing. It is proposed to install 20,000 kilowatt sets, and coal is assumed to be within a reasonable distance; the cost of the coal, with a net calorific value of 10,000 therms per lb., is for the purpose of the schedule assumed to be 10s. per ton at the works. The incombustible contents of the coal would amount to 20 per cent. The average water temperature is taken to be 60 deg. Fah., and the vacuum 28.5 in., with the barometer at 30 in. The overall efficiency of the boiler-house plant is assumed to be 77.5 per cent., which should be obtained with modern boiler control.

Turbine makers are not all in accord as to the efficiency to be expected from turbines of the size under consideration when working on high pressures, and, in view of the difference between the view of experts, it will be advisable to look ahead and anticipate that the efficiencies of turbines of the size under consideration will be improved in the near future. For the purpose of the calculations a turbine ratio efficiency of 80 per cent. is assumed at both 200 lb. pressure and 350 lb. pressure with the steam superheated 150 deg. Fah. and a constant vacuum of 28.5 in. An alternator of 20,000 kilowatts capacity can no doubt be built to give an efficiency of 97 per cent, at unity power factor, thus making the turbo generator ratio efficiency $0.80 \times 0.97 = 77.6$ per cent.

* Before the Institution of Electrical Engineers.

Assuming bearing and other friction losses to absorb 2 per cent. the internal efficiency of the turbine will amount to 82 per cent.

Comparative Costs

The schedule shows the comparisons of coal, steam and heat consumptions for a 20,000-kilowatt machine running under the conditions mentioned, at 200 lb. and 350 lb. pressure by gauge at varying superheats; also at 500 lb. pressure absolute and 268 deg. Fah. superheat, at which pressure and superheat the total temperature will be 736.5 deg. Fah., which is about the maximum temperature at present recommended for the materials now being used in turbine construction. The schedule shows that the cost for coal when generating 175.2 million kilowatt-hours with a load factor of 100 per cent. will be £64,400 at the higher pressure—superheat 250 deg. Fah.—and £69,200 at the lower pressure with corresponding superheat. This is a saving of £4800 per 175.2 million kilowatt-hours, or 0.007d. per kilowatt-hour. Unfortunately, a load factor of 100 per cent. is impossible, and the conditions under which power stations are operated must be considered before even an approximate estimate of working costs can be arrived at.

To arrive at an estimated figure for the power stations under discussion, it is proposed to assume that the standing loss of the station designed for 200 lb. will be the same as a typical station—the Valley-road power station of the Bradford Corporation, i.e., 1583 lb. of coal per hour. It will be fair if the same basis is taken for the plant at 350 lb. pressure, with 8 per cent. added to the works standing loss representing roughly the higher temperature of the steam at the higher pressure. Standing losses must be approximately proportional to the top temperature, as this affects radiation, boiler exit losses, etc.

For a 20,000-kilowatt set the no-load consumption will be approximately 22,000 lb. of steam, or 3666 lb. of coal per hour, and the total steam consumption at any load is 22,000 lb. + 9.54 lb. of steam per kilowatt-hour for the plant operating at 200 lb. pressure, and 22,000 lb. + 8.6 lb. of steam per kilowatt-hour and 3729 lb. + 1.45 lb. of coal per kilowatt-hour for the plant operating at 350 lb. pressure and 250 deg. superheat.

In order to allow for changing over, for the period when two or more machines are temporarily running together at partial loads, for reduced efficiency, in the boiler-house due to adverse circumstances, and for the necessity of sometimes running the plant when it is not in the best condition, it will be advisable to add 5 per cent. to the figures obtained for the load consumption and 5 per cent. to the no-load loss of the turbine, thus making the consumptions and costs as below:

Table I:

	Maximum load of 20,000 kilowatts and 50 per cent. load factor 87.6 x 10^6 units per annum.	
	200 lb. pressure, 250 deg. superheat, 28.5in. vacuum.	350 lb. pressure 250 deg. superheat, 28.5in. vacuum.
Works standing loss in tons of coal	6,200	6,700
No-load consumption of turbo-generators in tons of coal.....	15,100	15,314
Load consumption of turbo-generators in tons of coal	65,300	59,867
Total	86,600	81,881
Lb. of coal per unit on station bus-bars	2.211	2.094
Total cost at 10s. per ton	£43,300	£40,940
Cost of coal per unit	0.119d.	0.1122d.

The foregoing relates only to the cost of coal; the remaining items which make up the total works costs are not likely to be affected by the use of higher pressures and temperatures. Oil, waste, and water are practically unaffected; repairs and maintenance may be increased, but not to an appreciable extent. The capital cost of the plant is an item that may be affected to a considerable extent, but, unfortunately, the increased cost of turbines, boilers, pipes, etc., due to the use of higher pressures and temperatures cannot be given in a paper of this description. Table II. below gives the steam consumption on the conditions specified:

Table II.

Steam pressure at turbine lb per square inch ab.	215	265	315
Total temperature of steam at turbine, deg. Fah.	688	688	688
Superheat at turbine, deg. Fah...	300	281.6	265.6
Total heat of steam (from 32 32 deg. Fah.) therms per lb. ..	1371.3	1368.6	1365.9
Absolute pressure at turbine exhaust, inches (Hg.).....	1.5	1.5	1.5
Heat drop per lb. of steam, therms	429.2	440.3	449.1
Ratio efficiency of turbine and alternator	79.5%	79.1%	79.0%
Steam consumption of turbine, lb. per kilowatt-hour	10.023	9.82	9.65
Total steam consumption of turbine, lb. per hour	200,460	196,400	193,030
Steam consumption per effective kilowatt-hour, lb.	10.3	10.10	9.94

With regard to the practical difficulties, it is but to be expected that before pressures of 500 lb. or 600 lb. per square inch are adopted, a radical departure will have to be made in present boiler construction. All square boxes and headers will be eliminated, the drums and tubes will be smaller in diameter, and the design of the boiler made more elastic. The type of boiler will no doubt assume the appearance of a flash boiler, with practically no steam or water reserve, and fired by gas on the surface-combustion principle.

For more moderate pressures, up to 350 lb. per square inch, the existing type of boiler can be modified and successfully used. At Carville power station, Babcock and Wilcox marine-type boilers are being used, at 275 lb. per square inch gauge pressure, and at the British Thomson-Houston Company's works at Rugby a Babcock and Wilcox boiler is installed and successfully working at 350 lb. per square inch. Further, Messrs. Babcock and Wilcox state that they have at present two boilers on order for a working pressure of 475 lb. per square inch with steam superheated to a final temperature of 700 deg. Fah., and that they are quite prepared to supply boilers in their ordinary business for such pressure and superheat.

With higher steam pressures the temperature of saturation is raised, and, due to this, greater care must be exercised in the quality of the water used for the boiler feed. A feed-water that is perfectly satisfactory at 380 deg. Fah. in a modern tubular boiler might be quite unsuitable for use in a flash boiler. The quantity of air, CO_2, and oxygen will have to be kept down to a minimum, and also the non-soluble salts which are generally in the water discharged from an ordinary lime-soda water softener. A natural development, and one which is already taking place, is to heat the feed-water under atmospheric pressure by means of live or exhaust steam in order to drive off the entrapped and dissolved gases as much as possible. According to Lunge's "Technical Chemist's Handbook," it is necessary to raise the temperature of the water to 100 deg. Cent. before the quantity of air in the water is appreciably reduced.

The source of water for use in high-pressure plants will have to be carefully traced, and the treatment of the water should be such that minimum of unsoluble salts remains in it after treatment. The purer the water the greater affinity it has for air, CO_2, and oxygen, and every care should be taken that it is not exposed to the air between the con-

denser and the boiler. In order to avoid such exposure to the air it is suggested that the feed pump should be an extension of the condensate pump and the condensed water pumped direct into the feed line.

For Higher Pressures.

The natural development of the turbine for higher pressures appears to be in a line with Parsons two-cylinder machine, with a flexible claw-type coupling between the cylinders and a thrust bearing for each cylinder. For very large sets, above 50,000 kilowatts, the cross-compound turbo-generator will no doubt be used, the high-pressure turbine being attached to a generator and the low pressure turbine to another generator. Each set can then be run at its most suitable speed, with resulting high efficiency. This arrangement will no doubt lead to re-heating the steam after it leaves the high-pressure turbine and before entering the low-pressure machine. Dr. Ferranti has already done valuable work on this subject the results of which have unfortunately not been published.

The design of the condensing plant is not likely to be modified because of the use of high pressure or high temperature steam, but it must not be lost sight of, that with steam initially at the same temperature, but at different pressures the plant using the high-pressure steam will reject less heat units to the condenser per lb. of steam used in the turbine.

The steam pipes to be used in a station where both high pressures and high temperatures are employed will have to be very carefully designed. The question of expansion at higher temperatures will be of the utmost importance. For example, take the case of a steam pipe 100 ft. in length, and assume that the pipe had been erected at 60 deg. Fah. It will be found that a temperature of 388 deg. Fah., equal to steam at 200 lb. gauge saturated, the expansion is 2.59 in., while at 786.6 deg. Fah., equal to steam at 600 lb. pressure and 300 deg. Fah. superheat, the expansion is 5.75 in.

The expansion given can be readily taken care of if the designer can ensure that the expansion would always take place lengthwise in the pipe range. Unfortunately, taking a boiler off a range will cause a considerable cross-strain to the main header, due to the connecting pipes cooling down and contracting.

It appears that the main steam connections of the boiler will have to be designed in a flexible manner, in order to relieve the main range of stress. Further, these connections should be of the manifold or header type, i.e., made up of many small pipe connections.

From inquiries, it is apparent that the boiler mounting and valve makers are quite alive to the possibilities of high-pressure and high-temperature steam coming into commercial use. The question of the use of higher pressures is quite appreciated by the makers of economisers, who are prepared to manufacture economisers for 350 lb. boiler pressure or higher, either of their standard design, with the details modified, or of a design suitable for use as an integral part of the boiler, if necessary with horiontal and mild steel tubes.

It must be admitted that in order to attain a higher overall efficiency, it is necessary to increase both the pressure and the temperature of the steam. An increase of pressure with a constant temperature would mean that the dew point is carried further up the turbine towards the high-pressure end, thus tending to accelerate blade erosion in the lower stages and a reduced stage efficiency of the turbine. Also the high-pressure blading of a turbine is considerably less efficient than the low pressure stages, and although the losses in the high-pressure end are partly recovered in the low-pressure blades, it is apparent that to assume that a turbine for extra high pressures can be built with the same efficiency as one for a lower pressure—within limits—is taking a hopeful view, and that there is justification for hesitation before adopting extra high pressures on the part of managers responsible for the financial results of large undertakings.

Women Conductors a Success in Baltimore

The first women conductors to be employed by the United Railways & Electric Company, of Baltimore, Md., commenced their new work on July 10, and since that time have taken to their duties so earnestly, and the public has taken to this innovation so naturally, that there appears to be no question but that they will be an unqualified success in holding the places of the soldier and sailor boys until the war is won and the "warriors" return to resume their old platform position.

There was not a large number—just half a dozen—in the first little squad that was graduated from the training school at Park Terminal, where the intricacies of their new profession had been explained and its principles expounded. This first installment of women conductors was placed on the vestibuled P. A. Y. E. cars of the St. Paul Street and Boulevard lines, and the number has been gradually added to until there were 15 on the cars July 19, and more to go into service shortly.

The reception of women conductors by the Balitmore public was similarly gratifying. There may have been in some quarters a disposition to feel that, while women had succeeded in this calling in other large cities here and abroad, there might be a difference in Baltimore—a southern city. If there was a difference in the reception given the women, it was a difference on the side of respect and hearty co-operation from the patrons of the cars and the press of the city.

The women conductors are to fill vacancies only and not to replace men except when the latter leave the service, their employment being strictly a war measure with the United Railway. They are to be paid the same scale of wages as the men—35c an hour the first year with an increase as the of one cent an hour each year of service. They are guaranteed a minimum wage of $75 a month (under the old scale of wages.)

The first day in service of the company the women devoted their efforts entirely to the mastery of opening and closing the doors, collecting fares and making change, while the punching of transfers and the calling of streets was done by the male conductor.—Electric Traction.



Permanent Electrical Dining Room Display in the New London Hydro Building

The Dealer and Contractor

Electrical Interests will Gather in Toronto on Oct. 14, 15 and 16 to Hear W. L. Goodwin and Discuss his Plans for Closer Co-operation and Co-ordination of the Entire Industry

Local arrangements have now been made for the meeting of the National Executive Committee of the National Association of Electrical Contractors and Dealers in Toronto on Monday, Tuesday and Wednesday, October 14, 15, 16. The meeting will be held at the King Edward Hotel, Toronto, and will be open to all branches of the industry. Members of the committee include: W. Creighton Peet, New York City; E. McCleary, Detroit; Harry C. Brown, New York City; W. K. Tuohey, Springfield; M. E. Arnold, Phildaelphia; G. M. Chapman, Waterbury; T. H. McKinney, Atlanta; P. H. Jaehnig, Newark; G. M. Sanborn, Indianapolis; J. N. Pierce, Chicago; J. A. Fowler, Memphis; Robley S. Stearnes, New Orleans; W. I. Gray, Minneapolis; J. F. NePage, Seattle; Sam. Jaggar, Portland; M. G. Buchan, Cleveland and Fred B. Adam, St. Louis.

The biggest event in connection with this meeting will be the presence of Mr. W. L. Goodwin, of the General Electric Company, Schenectady. At a dinner to be held on Monday night at the King Edward Hotel, Mr. Goodwin will explain his now famous plan of co-ordinating the various elements in the electrical industry, having in view better merchandising, better general conditions and a greatly extended use of electricity and electrical appliances of every kind. It is expected that this dinner will be attended by every electrical man in Toronto and that large numbers will also come in from outlying points. The president of the Toronto Electrical Contractors' Association, Mr. Kenneth A. McIntyre, and his executive committee, have the whole programme in hand and may be depended upon to see that everything is in readiness when Mr. Goodwin arrives. There is no question at the present time quite so important to the electrical industry in general as that which Mr. Goodwin comes to propound, and we have every reason to hope that the Canadian industry will profit in the near future from the application of his policy, just as benefits are being reaped already in the United States.

Every electrical man, whether manufacturer, jobber, dealer or contractor, is urged to keep these three dates available for close attention on this convention. The larger the attendance and the more fully the whole matter is discussed, just in this proportion will the immediate results be noticeable.

Reservations for the banquet may be made at any time with Mr. Kenneth A. McIntyre, 72 Victoria Street, Toronto.

The Moloney Electric Co. of Canada are extending their Toronto office space owing to rapid expansion of business, and their address now reads 1221-24 Traders Bank Building, Toronto. Mr. Geo. D. Laycock, sales manger of the company, has charge of this office.

Beattie-McIntyre, Limited.

It is announced that Mr. Geo. J. Beattie, of the Electric Shop, 72 Victoria Street, Toronto, and Mr. Kenneth A. McIntyre, electrical engineer and contractor, Excelsior Life Building, Toronto, have formed a partnership under the name of Beattie-McIntyre, Limited. The headquarters of the new firm will be at 72 Victoria Street, and the field covered will include contracting, electrical engineering, power apparatus, labor-saving devices, illumination, etc. Mr. McIntyre will specialize on construction and Mr. Beattie will pay special attention to the commercial end.

Both of these names are very well known in the electrical field and the combination of two such experienced and competent heads into one business partnership gives this firm facilities for performing the very highest class of work over a very varied field. There can be little doubt that great success will attend their efforts.

Beattie-McIntyre, Limited, have a fine exhibit at Booth 88—the old Hydro stand—Industrial Wing No. 3, Process Building, Canadian National Exhibition, and extend a hearty invitation to visitors to look in on them.

A New Compensarc.

To give the close regulation of current essential for Mazda motion picture projection lamps, the Canadian General Electric Company are offering a new compensarc which provides protection against over current and regulation to within 1/100 ampere is obtained. It operates on the reactance principle and is furnished for standard a.c. voltages and frequencies in ratings of 20 and 30 amperes, corresponding to the Mazda lamps now on the market for this purpose. This compensarc is made up of a two-coil auto-transformer stacked with standard transformer punchings within a rawhide housing, the complete wiring of which forms the line side with the lamp terminals tapped across one coil. The coils are stacked so that room is left between them for an iron leakage plug in each side of the magnetic circuit. Turning a hand wheel on the shaft of the iron plug moves it in and out between the two coils, giving a very close adjustment for the lamp. Maximum reactance is obtained when the plug is all the way in. The only noise is a slight humming when the plugs are being withdrawn; this ceases when they come to rest.

Conductorettes on the motor bus and tramway systems in London, England, recently went on strike, completely tieing up both systems. The women claimed (and obtained) five shillings a week as a war bonus, the same as was recently granted to the men.

The building of steel ships without rivets is being accomplished in England and the United States by the use of electric welding. It is claimed that a saving of from 20 to 25 per cent. in time and material is possible by this method.

Why a Thorough Study of Selling Prices is Important

By J. E. Bullard*

Many a sale has been lost because the right price was not marked on the goods. The right price may have been lower or it may have been higher than the price marked. Time after time it has been found that a higher price will sell goods that cannot be sold for the price at which they were originally offered. There are also certain odd prices and there are quantity offers for different denominations of money that result in large sales.

Department stores have made such prices as 4, 9, 19, 23, 39, 98 cents and other odd prices quite famous. In fact the success of these large stores is no doubt due to a very great extent to the skill displayed in setting prices. The prices are not always low. In fact it is not low prices that are striven after so much as the prices that will appeal to the customers, the prices that in themselves will result in a desire to possess the goods. Even the automobile manufacturers have adopted the odd price method in selling their product to a rather remarkable degree. There are cars which have been or are selling for $360, $395, $995, $1,050, $1,450, $,1550, $1,-650, $1,950, $2,075, and various other odd prices, but there are few if any on the market that sell for an even $400, $1,000, $1,500, or $2,000. Apparently it has been considered easier to sell these machines at odd prices than at even prices even though their selling prices are comparatively high. Mail order houses also make a liberal use of odd prices. Even prices being used in such a manner as to make the odd prices more prominent results in people getting an exaggerated idea of the bargains the house has to offer.

Don't Use Too Many Odd Prices.

Too great a use of odd prices, however, may prove detrimental. Judgment must be used. The man who fixes the retail prices of any establishment has a job on his hands that is not dissimilar to the work of an artist. Just as the artist must select his colors and apply them to the canvas in such a way as to create a pleasing impression, the man who fixes the retail prices of a store must select them and apply them to the goods in such a way as to create a favorable impression upon the customers. The prices must give an impression of good values, but at the same time convey the idea that quality is not unduly sacrified to price. This is something that cannot be done without a great deal of study on the part of the price maker. He must study his goods, his prospective customers, the way other dealers in his and other lines do it in his vicinity and most of all he must be sure that he knows just the kind of effect he wishes to create and work towards that end.

If a store is catering to an exclusive set of customers, people who have large incomes and aristocratic tendencies, the prices determined upon and the setting given these goods would be radically different from the case where the middle class of people is being appealed to, and both these classes would have to be treated in a different manner from the case of laboring classes.

The aristocratic person wants everything to look expensive and exclusive. He wants to see expensive fixtures in the store; he likes to be admitted by a doorman in livery; he wants expensive service throughout and unless all this is included in the selling price, unless he pays very high prices for his goods, he is more than likely to suspect that the quality of the goods purchased is not up to standard. The result is almost bound to be dissatisfaction.

Department Stores and Mail Order Houses Have Studied Price Making.

There is probably no class of retailers which appeals to as many classes and types of people as do the department stores and the mail order houses. Through experience and study these institutions are often able to make the mere prices at which the goods are sold go a long way towards creating sales. It is these institutions that cater in a big way to the middle and laboring classes and it is their methods that are worth very serious study. All their methods may not be sound. Some of their methods could not successfully be applied to other businesses, but a study of them will prove of value to any business man. It will help him in solving many of the problems in his own business and may make it possible to sell a great deal more than could otherwise be sold.

Just at this time it is more than ever necessary that a great deal of attention be paid to the proper making of retail prices. At present odd prices are also more popular than ever before. If an article can be sold at a very narrow margin for 5c that is not a necessary reason why 5c should be fixed as the sale price. It is quite possible that the demand will be greater at 6c than at 5c. The 6c price indicates to the public that the article is of pre-war quality but that its sale price has been revised to war conditions, while a 5c price for the same article in addition to seriously cutting into the profit of the dealer might lead the public to suspect that there was something wrong.

The Public Affected by Impressions Rather Than Logic.

The general public is prone to be affected by impressions as much as by logic. It is the first impression that the price makes upon them that attracts from the business house. How little many people rely upon reason is illustrated by the following case:

A woman sent her little daughter over to the butcher store some years ago when meat was selling at retail for less than it is now selling at wholesale, to learn the price of round steak. The butcher sent back a note stating that it was selling for 12c a pound. Soon the little girl came back with a note from her mother stating that she would buy some steak if she could get two pounds for a quarter. Often when articles sell for 8c each people will insist on buying three of them for a quarter.

This being true it would seem wise to avoid, in so far as possible, setting prices of 8c and 12c on items that people will likely buy in quantites of two, three or more. The sales are pretty sure to be greater if the prices are set at 9c and 13c with the privilege of three or two for twenty-five cents. This will avoid all chance of embarrassment on the part of those customers who are poor arithmeticians. It will also yield a greater profit to the dealer and will probably increase the volume of sales because the better arithmeticians will purchase in larger quantities in order to save a few pennies.

How a Price Too Low Affects Sales.

Experiments have been tried that show prices too low affect sales. Many a mail order house has placed in its catalog an article marked at a real bargain price only to find that it did not sell. The only reason to be found appeared to be that the price was too low, that the price was so low indeed that the customers doubted the quality. By moving the price up and down one would eventually be found which would result in creating a big demand. This price would be

* Before the recent Convention of the N. E. C. A.

considerably higher than the one at which the goods were originally offered. It has been demonstrated time and time again that there is always a price below which it is not possible to go and give the public a reason that people will believe.

Years ago a couple of young men opened a cash provision store in which every article was sold for cash. It was in the early days of the cash store, and since these men had no bad accounts on their books, turned their stock many times a year and had a low overhead they were able to sell goods at a considerably lower price than were any of the credit stores in town. It was for these reasons that they could sell beans profitably for six cents a quart while all the other stores were selling them for ten cents. Samples of these beans were on display and were plainly marked at six cents a quart. Any customer had the privilege of carefully examining them. A little observation, however, soon showed that only the poorest class of people were buying beans in this store. The better classes might buy their salt pork, on which the saving was not so great, but only the poorer classes purchased beans. As an experiment two display cases at the front of the counter were filled with the same beans. One was marked six cents a quart. The other was marked eight cents a quart. The result was that thereafter the better classes of people began to buy their beans here. The poorer classes paid six cents because they were buying on price alone. They wanted the cheapest regardless of quality. The better classes purchased because it seemed reasonable that this concern could undersell their competitors by as much as two cents a quart. It did not seem reasonable to expect that they could undersell by as much as four cents. They, therefore, paid eight cents for their beans.

A Low Bid Does Not Always Get the Job.

There are many electrical contractors who rarely get big and profitable jobs because in their anxiety to get the business they have shaved their figures so low that those in charge of letting the job fear that work which will come up to the specifications cannot be done at the price. Successful contractor after successful contractor will say that if they relied upon low prices alone to get business they would not be able to make a living. They claim that it is the quality of their work that creates new customers for them. It is more than possible, however, that should these same contractors make a bid on a job at a price very much below the price current for quality work they would be given an opportunity to revise their figures before the job would be given to them. In some cases so much suspicion might be aroused by the low price that the bid would be thrown out altogether.

Every reasonable person knows that no business man can remain in business unless he is doing business at a profit. If below cost prices are featured everyone knows that the loss must be made up in some other way. The result may mean greater cost to the public than would have been the case if a reasonable price had been paid for the first articles or service. As time goes on people come more and more to realize this. It is necessary, therefore, to have much better reasons for low prices than for high prices. High prices, in themselves, imply quality. In any case it is apparent that there is no "nigger in the wood-pile" who is going to come out and rob the customer in some other way and not nearly as much suspicion will be aroused as would be the case if the prices were too low.

Public Utility Companies Should Not Cut Prices.

That public utility companies have made a very serious mistake in selling appliances at less than cost, as many a gas and many an electric lighting company has done, is evidenced by the fact that those which have maintained a seasonable retail price are to-day enjoying far greater good will than those which have sold their appliances at prices so low that it was impossible for any dealer to compete with them on a price basis. Those central stations that have been selling appliances at less than cost and which to-day find it necessary to increase their rates are far more likely to meet with bitter opposition from the public than those which have been maintaining their sales department on a strictly business basis and making it pay its own way.

Department stores are coming more and more to realize that it is not good policy to make big cuts in prices in advertised goods. If the cut is too great it has a detrimental rather than a good effect upon the good will of the customers. It is for this reason that many a store explains why it can sell these goods for less money than their advertised prices. To-day a cash basis of doing business is given as an explanation of low prices. It is a logical one and makes it possible for the dealer to offer lower prices than would otherwise be acceptable.

Cut Prices Are Not Necessary.

There are many dealers who consider it essential to cut prices on certain leaders in order to attract people to their place of business. They feel that people will not patronize them unless some exceptional bargain is offered to them. From one point of view their reasoning seems perfectly logical. On the other hand, however, it is easy to see that the exceptional bargain offered, which in some cases may actually be selling articles for less than they cost the dealer, is going to plant seeds of suspicion in the minds of the public and that when the purchaser visits the store it is going to require a much higher degree of salesmanship to allay this suspicion than would be the case if no such exceptional bargain had been offered. During these times of reduced labor supply some difficulty may be experienced in securing the quality of salesmanship that is required and the path of safety lies in avoiding price cutting.

A certain man held the view that cut prices are a mistaken business policy. About ten years ago this man started in a line of business where possibly the practice of price cutting is more rampant than in any other line, namely the automobile accessory business. He adopted the practice of selling goods at the list price if the discounts from list did not allow him too great a profit. Where the discounts were great he allowed a reasonable profit. He has always adhered to this practice and to-day is the owner of a chain of several stores and is adding more every year. Each of these stores is competing with both local and city price cutters as well as the mail order houses. Each, however, is a profitable enterprise, though many of the price-cutting competitors have gone ou of business. He has built up a reputation of quality goods and quality service that is of far greater business value than would have been a reputation for price-cutting. To-day when a car owner wants to take a chance he may buy an article or two from some of the price cutters, but when he wants real reliable service he patronizes the store where prices are never cut but where quality and service are always maintained.

It is evident that there can be no fixed rules laid down for price making, it is equally evident that while high prices, that is, prices which are too high, may drive away trade, prices which are too low will result in creating distrust and ill will. The one best price can only be arrived at by careful experiment and study. This price, however, is always sure to yield enough profit to make it well worth while to devote the time and study to the problem that it requires.

The six cent fare has been inaugurated on the Detroit electric railway. The company is experiencing considerable difficulty in collecting the six cents.

Engineering Features Essential to Success of Farm Lighting Business

By Evan J. Edwards*

Various expert conclusions have been given as to the possible magnitude for country home lighting, and these estimates range from three to six million installations. Taking, say, a conservative figure of 4,000,000 installations and assuming an average expediture of $1,000 per installation, the total runs into a figure which before these war times would be quite inconceivable because of its magnitude. Four billion dollar estimates are mentioned quite casually in regard to war-time expenditures, but still stand as being colossal when applied to possible business for a new branch of the electrical industry. I will agree that there is a good chance that many calendars will be used up before there are 4,000,000 installations in this country, but the less optimistic ones may cut the figure to one-half or one-fourth if they wish and the total will yet be impressive. It surely is not unreasonable to compare the possibility of this field with that of the automobile as used by the farmer. Statistics show that there are between two and three million automobiles in the hands of farmers at the present time and some of them are their second and third purchases.

The selling of one country home lighting installation means more in business than the initial $1,000 expenditure. Additional equipment and supplies will be needed as time goes on. Lamp and battery renewals will be a factor.

It is likely that this business will not be handled exclusively by any existing type of dealer. If the present dealer in electrical supplies is to handle it, he may have to learn much about selling things to the farmer. In other words, his biggest job is to learn the farmer, but he must also inform himself as to the engineering relating to these plants, particularly as regards the points of difference compared with 110-volt installations with which he is already familiar. If some other class of dealer already accustomed to selling to the farmer is to take up the business, he must learn everything regarding the electrical side of the business, which is no small job either. Opinions vary as to which of these present dealers has the advantage.

Coming then to the main object of this paper—there are certain important engineering points which are essential to the success of the business and which should be kept in mind by the dealer, whoever he may turn out to be.

First of all, there must be proper recognition of the field for these plants. They are in no case competitive with good central station service. Arguments to the contrary cannot be substantiated by complete facts. They are not adapted to heavy power work. Some of the standard plants are advertised as being light and power plants, but they should be looked upon as essentially for lighting. Heavy power work of the farm cannot be handled economically by the use of motors operating from an isolated generating plant. A standardized plant as now put on the market is of the correct capacity to operate effectively and efficiently the lighting of the average farm premises and can very well handle certain small power work, such as pumping water, separating cream and running the washing machine, but should not be considered for the feed grinder, ensilage cutter and the threshing machine. Hop and Brown acted wisely in informing their enthusiastic prospect that the heavy motor loads were out of the question.

One of the most important engineering questions is that of standardization. Experience in other lines has shown that commercial progress can be measured by progress in standardization of equipment and methods. Satisfactory progress has been made to date in the standardization of country home lighting plants. It is seldom now that anyone mentions a battery equipment other than 16 cells of lead-acid or 24 cells of nickel-iron-alkaline. There are plenty of arguments which could be advanced in favor of both a higher or lower voltage, but 30 volts (nominal value for present standard) is a good compromise and it is to the best interests of everybody concerned that the present voltage standards be strictly adhered to. The lamp and appliance manufacturers have designed their product to best meet the operating conditions as obtained with the above battery equipment. The lamp manufacturers label their product 28-32 volts, meaning that the lamps are designed for these plants which by their nature vary in voltage between these limits in the properly installed standard outfit and wiring.

Some other points of standardization are not so well taken care of.. There is much mechanical standardization which could be accomplished along the lines done by the Society of Automotive Engineers in connection with automobiles. The meter equipment on the switchboards and the method of control of the circuits show considerable variation. There are also certain features of battery design, and particularly methods of battery rating, which could be standardized to advantage. The important point at this time is to appreciate the value of standardization and to bear in mind that the manufacturer who departs from present standards without very well substantiating his reason for doing so, is retarding the progress of the business as a whole. The manufacturer is primarily responsible for standardization of the plant, but a proper appreciation of the value of standardization on the part of the dealer will greatly assist.

It will be up to the dealer who sells the plant to see to it that proper installation is made. A good foundation for the generating unit should be provided; a heavy concrete base is usually advisable. Thought should be given to the location of the generating unit and batteries. It is, of course, advisable to locate the plant near to the heaviest and most important load, which is the house-lighting. The basement of the house is often chosen for this reason and it has the added advantage of more uniform temperature than an outbuilding would have. The batteries are not exposed to the high evaporation rate of the outside summer weather nor to the danger of freezing in winter. It is important to shelve the batteries in such a way that they are substantially supported and easy to get at for inspection and filling. They should be well lighted, so that the owner will readily discover any need of attention to the cells.

The Question of Wiring.

For the man who is accustomed to installing 110-volt systems, perhaps the greatest pitfall in this new business is that of the wiring. He should appreciate that a mere table of current carrying capacity as put out by the underwriters is not adequate. Thirty volt plants have four times the amperage as a necessary consequence of having only one-fourth the voltage, and furthermore, the 1-volt drop, which is 1 per cent in a 110 volt installation becomes a 4 per cent drop in 30-volt installations, and it is the percentage drop which counts in the operation of incandescent lamps and other appliances. If I may refer again to the story of Hop and

* Before the recent N. E. C. A. Convention.

Hereto, you may recall the wiring chart which has been designed to furnish a ready means for obtaining wire sizes which will hold the voltage losses within proper limits. The use of this chart also avoids the guessing which might result in the use of larger wire than necessary in certain parts of the installation. No. 14 is suitable for considerable of the wiring, the same as in a 110 volt installation. In places where larger wire is needed, however, it is needed badly, and the final success of the installation will depend to a considerable extent on having the wiring right.

It is a mistake to assume that the farmer will be satisfied with drop cords and key sockets, even though at first he may think that he is going to be. It is better in almost every case to sell him a wiring installation for his house which is fully up to the standards of the city. Wall switches and baseboard outlets with the handy features of control will be appreciated by the farmer. The farmer is a man of pride and in no sense a piker when it comes to spending money for things that he wants and are worth what they cost. He will have lasting satisfaction only in an installation up to the standards of his city brother. Furthermore, if he does not have convenient switching and flexibility as to outlets he is only half cashing in upon the benefits which are inherent in electrical lighting.

Fixtures and glassware are important. The fixtures can be simple and yet correct in their design. The farmer in his experience with coal oil lamps may not have discovered the devil glare. He may even be inclined to judge the value of a light source by its intrinsic brightness rather than by the resulting illumination of the objects which he desires to see. Nevertheless, in the long run, he will be better satisfied if objectionoble glare has been entirely done away with. Here is the reason for the importance of supplying good reflectors. There may be places in the outbuildings of the farm where bare lamps are not particularly obectionable, but certainly in the house every lamp should be provided with a reflector which protects the eyes from the glare of the filament and at the same time increases illuminating efficiency by directing the light to the lower angles where it is needed.

There are other important points and many elaborations of the few points mentioned here which deserve the thought and attention of those directly interested in pushing the business, but it is sufficient here perhaps to give as I have a very brief treatment of a big subject. I have attempted only to call attention to the possiblities of this new field in the electrical business, and to mention the several things which seem to me to be of greatest importance in attempting to minimize the mistakes that always retard a new development.

Electrical Merchandising a Normal Extension of the Contractor's Field

By M. H. Johnson*

A retail electrical store is a logical step for contractors and dealers toward improving their own situation and general conditions governing the distribution of electrical merchandise. All contractor-dealers, with the exception of a very few who are specializing in their work, are now obliged to have a place of business and a stock of merchandise that are quite suitable to be used as retail stores and this step may be regarded as a normal extension. The character of the business is really simpler than that ordinarily carried on by electrical contractors.

Necessary Primary Steps in Opening a Retail Store.

Those starting to conduct a store will usually find it necessary to clean up their place of business, provide a cash register, counter and display shelves and perhaps add to their stock a small assortment of household appliances. Further than this, a few cardinal principles strictly adhered to and the exercise of common sense is almost certain to result in the development of a paying business not only in the sales made directly from the store, but in the natural development of the construction business by the store and hence the store business from construction work.

The prime requirement for a successful store is to have it attractive, especially so to women. This involves cleanliness, neatness and an interesting display of merchandise. All merchandise shown in the store should be plainly morked with the maker's name and catalogue number, and the selling price, which should be strictly adhered to. Every device displayed for sale should be in such shape that it can be demonstrated upon request. Furthermore, someone capable of understanding and showing the use of the device on sale should always be in the store. With a little training this can usually be done very satisfactorily by the young lady, who is almost universally present in such establishments in the capacity of bookkeeper and stenographer.

An attractive store and courteous treatment are the first essentials and almost certain to bring success. Generally speaking, the sale of electrical merchandise affords all the business a contractor-dealer can handle to advantage and many disasters have resulted from stocking the store with toys, automobile appliances and catch-penny devices.

Inducing the Public to Visit Your Store.

The best method of bringing trade to the store depends partly on the community where it is located and partly on the amount and character of the business normally handled by the individual concern.

In the very large cities the best advertising is done by the window displays and outside signs. In second-class cities newspaper advertising is valuable. In smaller communities moving picture advertising produces good results.

In all cases the word of mouth by the contractor's wiremen and solicitors among customers for construction business is one of the most potent factors.

The sale of domestic machinery, washers, ironers, vacuum cleaners, ice machines, dish washers and ranges is only successful where given special attention by personal solicitation, a careful system of following up prospects and more or less extended terms of credit. Trade of this kind with persons of poor or doubtful credit is generally unprofitable because of the cost of collections.

The sale of seasonable merchandise, covering fans, toys, Christmas tree lighting outfits, to some extent vacuum cleaners and flat irons, will pay when given intelligent attention. To do so requiries great care as to the quantities purchased having the right goods on hand at the right time and judicious advertising, to coincide with the natural demand.

The giving of credit on store sales is important, as some of the best customers prefer it, and besides it helps to give the buyer confidence in appliances they have not been ac-

* Before the recent N. E. C. A. Convention.

customed to. The extension of credit calls for careful oversight and the best information can usually be had from the local Board of Trade or Chamber of Commerce.

Render a Service.

All the foregoing is rather primitive to those who have been in this line, but it is perfectly safe to say that no electrical merchant at the present time is overdoing the above suggestions. For those who have gone some distance in developing this end of the business, the much abused word "service" will bear unlimited consideration and always return profits, financial and otherwise. The only means of replacing the drudgery of this business with the satisfaction of results accomplished is to play the game on the level. It is often called "the game" thoughtlessly. However, the slang expression is underlaid by a world of truth. Ability to convince your friends and customers (they should always be synonymous) that you can supply their electrical needs to better advantage than anyone else is an especially pleasing achievement and the stake it always brings in is profitable business.

The customer to whom you have sold the device he needs and which gives genuinely satisfactory service will remember this fact long after he has forgotten that he paid you more than the other fellow asked and will invariably come back for more when he needs it.

There is, furthermore, at this time an obligation resting on all of us to put our affairs in order and develop our business along lines which will pass the maximum of electrical appliances in service at the minimum of expense.

It is essential of every electrical device that it has a useful purpose; that it will produce the result wanted quicker, cheaper or better than can otherwise be done. It follows that every electrical device put to the service for which it is intended effects a conservation in some form and conservation is now the universal watchword of the country.

Devices for better lighting permit of more work and better work being done. The electrical heating devices must produce results at a saving or they are not successful. The many labor saving appliances do, of course, conserve energy, which may be used for other purposes. Our business is the one relied on to advance civilization. Its development coincides with the development of civilization.

It is, therefore, up to us, the connnecting link between the producer and the ultimate user of things electrical, to neglect no opportunity for the better service of the country along this line, as we cannot make the supreme offering which so many of our friends have done.

In the Campaign for More Convenience Outlets

What the Wiring Contractor Should Do

1.—Visit the new-business manager of your local central station and arrange to secure through him a list of prospects for outlets and wiring, in the home, the office and factory.

A—Classify your prospects according to districts and character (home, office, factory).

B—List each classification separately; be sure to include the address, and, where one is used, the phone number.

C—Work out your plans for securing business from each such prospect.

D—Notify the Society at once regarding the number of special letters and folders that you will mail out to these prospects.

2.—Decide what outlets and receptacles you will sell and install. Be sure that you can explain the construction, purpose and special features of each.

3.—Work out several typical examples of estimates for installing outlets and wiring. That will enable you to supply prospects with a concrete basis for understanding just what they can expect for their money.

4.—Select such of the advertising and selling helps pictured and described in this issue that you can and will make use of. Order them from the Society at once—NOW!

5.—Decide what advertising you will have inserted in your local paper. Supply the newspaper with the copy and cuts, and make arrangements for schedule of insertions, etc.

6.—Hold meetings with those who will solicit orders for outlets and wiring for you; discuss the best methods to pursue; see to it that each man understands what he is to do.

7.—Confer with your local campaign committee; explain what preparations you have made; ask them what further they have to suggest and what they will do to help you.

8.—Communicate with the Society, explaining the steps you have taken and requesting further suggestions.

J. Everard Myers, 4 Gould St., Toronto, has been awarded the contract for re-wiring the factory and installing a quantity of electrical equipment, for the Gendron Mfg. Co. Ltd., 137 Duchess St., Toronto.

What the Contractor-Dealer Should Do

NOTE—You, being a contractor as well as a dealer, will, of course, profit first by the suggestion given for the wiring contractor. In addition:

1.—Decide what time, labor, money-saving electrical appliances you will feature and push during the campaign.

A—Draw upon the manufacturers of those appliances for descriptive literature and special selling helps and information about their respective products. They should be glad to assist you.

B—Invite them to have their travelling representatives call when in your neighborhood and supply first-hand information regarding the strong selling points of their products.

2.—Train those who will meet the trade and sell appliances, so that they will be in a position to advance real sales-producing arguments, facts and figures calculated to convince all prospects and induce them to buy.

3.—Arrange your mailing list of all good prospective purchasers of appliances.

Notify the Society how many mailing pieces you will need for your direct-by-mail campaign to these prospects. Select the mailing pieces from the Sales Service.

4.—Estimate how many price tags you will require and order them from the Society at once.

In case the information which should be written on the tags is not readily available, put someone to work at once digging it out.

5.—Confer at once with whoever arranges your window and store displays, instructing that person to (1) read this copy of the Sales Service through carefully; (2) plan out and make all arrangements for installing window, store and counter displays that will surpass all previous efforts.

In making displays, remember the power of suggestion: The sale of an appliance suggests the purchase of an outlet, and vice versa. Arrange for making your displays accordingly.

6.—If in doubt, don't guess, don't fuss, fume or worry—put it up to your local committee and to the Society.

Connectors for Current Transformers

The two purposes for which current transformers are used are—to reduce the current in the circuit to a value adapted for use with instruments, and to insulate the instruments from the high tension circuit. The design of the transformers is such, that the secondary current is a definite proportion of that of the primary current for practically any value of primary current which may flow. A single-phase circuit having a current transformer is illustrated in Fig. 1, where L represents the load of the circuit, and I the current flowing in the direction shown by arrows at a particular instant. The meter M connected in the secondary of the current transformer has a scale marked to indicate the current flowing at A, thereby taking account of the ratio of transformation in the current transformer. The meter M

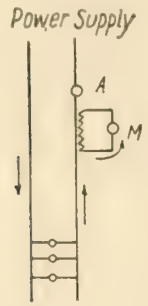


Fig 1.

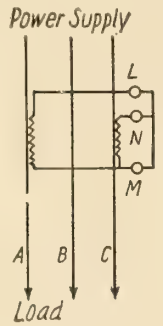


Fig 2.

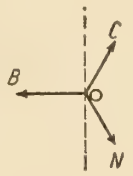


Fig 3.



Fig 4.

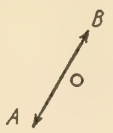


Fig 5.

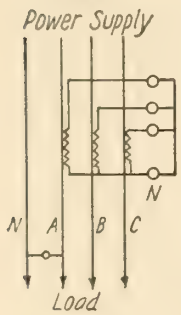


Fig 6.

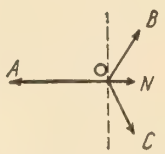


Fig 7.

therefore reads exactly the same current a direct reading meter would if connected in the line at point A. The connection of current transformers on polyphase circuits are in some cases rather complicated and we will consider the more common connections in detail.

The most common connection for three-phase three-wire circuit is the reversed V connection shown in Fig. 2, in which two current transformers may be used to indicate the current in all three wires. The current from the transformer in phase A flows through the instruments L and M and so far as the instrument L is concerned is essentially a single-phase connection and instrument L will indicate the current in the Line A. Similarly, the current from transformer C flows through the instruments N and M and the instrument N indicates the current in the line C. The combination of the above currents flowing through the meter M will also indicate the current in line B. This fact is illustrated by the vector diagram in Fig. 3. In considering this diagram let us assume that when the arrow points to the right, that the current is flowing in a particular direction which we will call "positive" and when the arrow is pointing to the left it is flowing in the opposite direction or "negative". When the arrow points up or down the current will therefore be zero and the value of current in any line will be proportional to the distance from the vertical line drawn through O to the point of the arrow.

The current in the lines A and C are represented in Fig. 3 as both positive and each to be one-half their medium value. The current in line B is represented as being negative and at its full maximum value. Now the law of electric currents, known as Kirchhoff's law, is that at a junction of conductors, such as at O, the sum of the positive and negative currents is zero; that is that any current flowing into this point on one or more conductors is equal to the current flowing out of the same point on one or more other conductors. The current in B being negative flows toward the point O and is therfore equal to currents A and B flowing away from this point. Therefore, the current in line B is the vector sum of the current in the lines A and C. Now, since the currents in the instruments L and N are exactly proportional to the currents in the lines A and C, then the current in M must be proportional to the current in B. In Fig. 4 the current in C is illustrated as being zero and at that instant the currents in B and A are equal. The current in instrument N is therefore zero and since the current from A flows through the meters L and M, their readings are necessarily equal, which, as can be seen from the diagram, is necessarily the case.

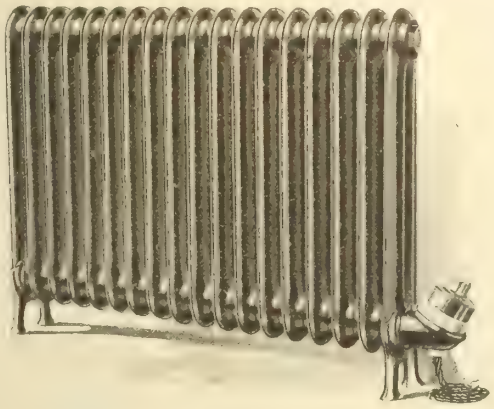
This connection for instruments may be used for ammeters, relays, trip coils or the current coils of wattmeters or power factor meters, and in fact any current carrying coil whatsoever. However, there are some objections to using this connection for protective relays and trip coils which will be considered later in a discussion of the "Z" connection.

In the above we have considered that the three-phase load was perfectly balanced. The indication of the meters, however, will be correct as well for any unbalanced condition. The worst unbalancing possible is to have a single-phase load on two wires with no load on the third. Suppose a single-phase load is connected across wires A and B—The current will then bear the relation as shown in Fig. 5, that is if current in A is positive, the current in B will be negative and of the same value. The current from transformer A will flow through the instruments L and M indicating an equal load on wires A and B and no current will flow in N, indicating no current in C. Suppose again that a single-phase load is connected to lines A and C—The current from line A will flow through instruments L and M as before and current from Line C will flow through instruments M and L. These currents flow through instrument M in opposite direction and being equal are canceled. Instrument M therefore indicates zero current in line B, which is correct.

In case of a three-phase four-wire system, it is necessary to use three transformers which are usually connected in Y or star as shown in Fig. 6. Since it is possible for some load to be connected between one phase and neutral, such as between A and N as shown, the current on the other phases is thereby unbalanced so that it is necessary to use three transformers. With the connections as shown, each instrument being connected to a transformer in each phase, the operation is essentially the same as for single- phase. In Fig. 7 the current which flows into the junction of conductors does not necessarily flow out at B and C but a position may be carried off on the line N. The instrument at N will indicate the value of current flowing in the neutral wire N.

The Salisbury Heater.

The Salisbury Electric Co., Ltd., have distributed a little folder describing the Salisbury Electric Radiator. This is a pressed steel radiator, filled with a specially prepared, non-corrosive, non-inflammable liquid, in which the heating element is immersed. The heater is made in various types, ranging in capacity from .6 to 2 kw. The smaller size is arranged for single heat only, but other sizes are provided with 3-heat switches and connections. This company are also now marketing an electric water heater, as well as the standard household appliances.



Hubbell Specialties Now Made in Canada

Announcement is made elsewhere in this issue that the Harvey Hubbell Company of Canada have established in Toronto a completely equipped factory for the manufacture of Hubbell electrical specialties. The new factory has been operating for some time as a matter of fact and has been accumulating stock in anticipation of the demand which will follow the present announcement.

The Toronto factory, which is situated on Labatt Ave., will turn out pull, key and keyless sockets, attachment plugs and receptacles, shade holders, lamp guards, reflectors, etc., in effect, the complete line of specialties so well known to the Canadian trade.

No better guarantee could be given of the service organization of the new company than the fact that it will be under the management of Mr. E. G. Mack, the efficient managing director of the Crouse-Hinds Co. By locating the Hubbell factory in close proximity to that of Crouse-Hinds Co., Mr. Mack will be able to co-ordinate the two organizations and no doubt will win for the new company as enviable a reputation as the Crouse-Hinds, under his guidance, has long held.

We understand that everything is in readiness for immediate shipment of any and all Hubbell equipment orders.

The Lancashire D. & M. Co. in Larger Quarters.

The Lancashire Dynamo and Motor Co., announce that after September 1st, 1918, they will be located in new and larger premises at the corner of Niagara and Bathurst Streets, Toronto, where they will be equipped to handle machinery efficiently up to ten tons, and where the facilities for repairing and rewinding will be much improved. The company will be in a position to give all customers prompt and efficient service.

Lieut. Alan Sullivan, formerly secretary of the Canadian Electrical Association, who recently joined the staff of the Royal Air Force, met with an accident recently, due to engine trouble, which necessitated several days in the hospital.

Trade Publications.

Sangamo Meters—Bulletin No. 48, issued by the Sangamo Electric Co., Springfield, Ill., describing their Type M.S. ampere-hour meters. The principles of this mercury-motor meter are described and illustrated in great detail, as well as its many commercial applications.

C.G.E. Publications—Bulletin No. 43411, illustrating and describing the lighting of windows and show cases with Edison Mazda lamps. Also Catalogue No. 257, describing and illustrating "Regent" globes and reflectors for commercial and ornamental illumination.

Disc Insulators—Catalogue No. 2, by the Jeffery-Dewitt Insulator Co., Huntington, W. Va., describing their high-tension disc insulators. The illustrations show in detail the dimensions and construction of the various types. The frontpiece shows the effect of 600,000 volts, 100,000 cycles, on 5 J.D. discs.

Telephone Economy—A folder issued by the Bell Telephone Co. of Canada, being a reproduction of a series of newspaper advertisements designed to point out to their telephone customers the possibilities in the way of co-operation between the company and the customer with a view to making their service more perfect and operating it more economically.

Condulet Suggest 55,—by the Crouse-Hinds Co. of Canada, illustrating an actual installation in one of the larger cotton mills of the United States, of YC condulets. Other types of the Y series, included in the same installation, are also shown. The Crouse-Hinds Co. have also issued a supplement to Bulletin 303, known as 303 A, describing Imperial flood lighting projectors, type SDXN designed for river and harbor service.

The Steel City Electric Co., of Pittsburg, have issued Catalogue No. 33. This is the first edition of the complete catalogue ever distributed by this company and marks the discontinuance of their previous plan of issuing separate bulletins of their various products. Copies of the catalogue may be had on request. A noticeable feature in connection with this catalogue is the index on page 101, which will be found a great convenience to the intending purchaser.

Trutint Units—booklet being destributed by the Canadian General Electric Co., describing the Nela Trutint units for general illumination, which are distributed in Canada by this company. These units are specially valuable for color matching in general retail stores, and are also coming into use in art stores and galleries, industrial and many other plants. Wherever true daylight at any time of the day or night is a valuable asset, these units are of special value.

Illuminating Glassware—Catalogue No. 6, illustrating color decorations, etchings, cuttings and other finishes on the illuminating glassware of the Jefferson Glass Co., is a handsome booklet of 70 pages, thoroughly well illustrated with full page cuts and containing complete information as to dimensions, prices, standard packages, etc. The Jefferson Glass Co. are also distributing a catalogue describing the 2-piece lighting units, "Dominionlite" and "Jeffersonlite," and the Maple Leaf bowl. These are popular 2-piece units noted for their efficiency in office or industrial work.

Westinghouse—Catalogue 1-B., wiring devices and carbon circuit breakers, is now being distributed by the Westinghouse Electric & Mfg. Company; this is a 224-page, 8½ x 11, catalogue listing fuses, knife switches, service switches and boxes, solderless connectors, disconnecting switches, instrument switches, safety switches, safety panel boards, safety floor boxes, and carbon circuit-breakers, part of which have previously been listed in the old sectional 3001 catalogue. The Westinghouse Company have also issued a revised edition of Catalogue 3-B in which are included for the first time the types AW and FW duplex instruments.

Current News and Notes

Beauce, Que.

La Manufacture de Boites de St. Evariste, Limited, has been formed to deal in electricity in the district of Beauce, Que. The capital is given as $20,000.

Fort William, Ont.

The Fort William end of the electric street railway system carried 2,672,144 fare passengers during the year ended June 30. The car mileage for the year reached the total of 629,688 miles. The gross earnings from operation amounted to $117,452; the net income or loss was $32,914. Operating expenses reached the sum of $94,177. The taxes, funded debt, etc., totaled $56,190. The total main track mileage of that end of the system is 19.88. The Port Arthur system carried 2,624,461 passengers, the mileage totaled 650,885. The net income or loss was $46,474; gross earnings from operation, $11,609; the operating expenses totaled $91,986; the taxes, funded debt, etc., reached $69,097, and the total main track mileage in use is 12.43.

Lake St. John, Que.

With a capital stock of $99,900, les Minoteries Electrique de Metabetchouan, Limited, has been formed to exploit and deal in electric power in all the parishes of the county of Lake

Montreal, Que.

A general increase in wages to all telephone employees is announced by the Bell Telephone Company, to become effective on the first of September. The increases vary from 25 per cent. in the case of lower salaried employees to 10 per cent. for those receiving higher wages. It is stated the increases will amount to approximately $1,300,000 a year, $825,000 of which will go to the operators.

Electrics Limited has been incorporated as a joint stock company. Head Office Montreal; capital $50,000.

Mr. R. A. Ross, of Montreal, has been appointed chairman of the Commission on Lignite, appointed by the Dominion Government. Mr. J. M. Leamy, provincial electrician, Winnipeg, and Hon. J. A. Sheppard, former speaker of the Saskatchewan Legislature, are the other members.

Niagara Falls, Ont.

The National Abrasive Company, of Hamilton, have decided to move to Niagara Falls and not to Renfrew, as formerly reported. The power shortage in Hamilton is responsible for the move and considerable indignation is evident because of the statement that the Ontario Hydro-electric Commission could grant a power allotment of 5,000 h.p. at Niagara Falls and not at Hamilton, where the factory was already established.

North Vancouver, B.C.

In a resolution passed unanimously by the city council of North Vancouver it was decided to ask the Union of B.C. Municipalities, at their convention in Penticton in September, to endorse a petition to the provincial government for the establishment of a hydro-electric commissioin for the development and control of British Columbia water powers. This commission would take pattern from the activities of the Ontario Hydro-electric Commission.

Port Arthur, Ont.

Claiming that the gross earnings of the company have not been as large as expected this year, through limited operations of the elevators at the head of the lakes, the Kaministiquia Power company submits its report for the month of June. Despite all this, the report is able to show increased net as well as gross earnings, although the expenses rose slightly more than the earnings. The gross earnings were $34,778 as compared with $33,015, an increase of $1,763; after allowing for operating expenses, maintenance and fixed charges, the surplus was $20,993 as compared with $19,708 for June, 1917. For the eight month ending June 30, the gross earnings were $277,644, as compared with $251,991, a gain of $25,653; for the same period the surplus was $165,351, as compared with $151,625, an increase of $13,,726.

Point-aux Trembles, Que.

A new lighting system has been installed at Point-aux-Trembles, Que., consisting of 196 lamps, each 250 c.p.

Regina, Sask.

The city council of Regina have decided against any increase in fares on the electric railway. Methods of making this mode of travel more popular with the public have, however, been suggested and the city will also secure estimates on the cost of equipping the rear vestibules with outer doors for use during the winter months. Automatic trolley catchers will also have to be installed in this event.

Rosthern, Sask.

Another Venn Severin engine, an exact duplicate of the one now in use, has been ordered for the Rosthern power house. The extension is made necessary by large increases in the demand for power. New street lights have also been installed in Rosthern.

St. Thomas, Ont.

The hydro-electric commissioners of St. Thomas, Ont., have applied to the provincial commission for an extra allotment of 400 horse-power to supply the demand of industries in that city.

Unionville, Ont.

On September 16 the ratepayers of Unionville, Ont., will vote on the question of extending the hydro transmission line from Agincourt to their municipality. The by-law, if passed, will provide for an expenditure of $10,000, which will be borrowed for the purpose.

Vancouver, B.C.

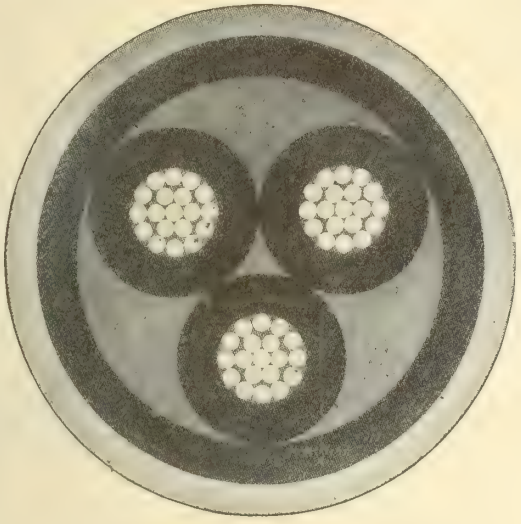
It has been announced that the B. C. government will appoint a Public Utilities Commission to handle such situations as that existing between the B. C. E. R. Company and the city of Vancouver regarding an increase in fares. The Commission will be invested with wide powers, not only over public utilities but also over municipalities. It will have authority similar to the Dominion Railway Board to hear and investigate complaints, make orders as to service and inprovements, fix the rates to be paid and make investigations into the affairs of companies for the purpose of ascertaining the financial returns necessary for successful operation.

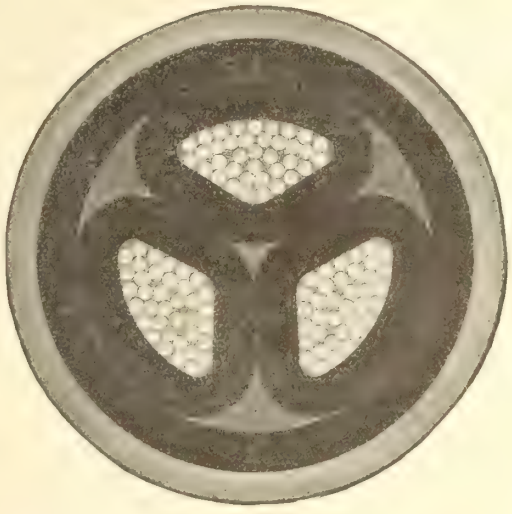
Winnipeg, Man.

The monthly report of the Winnipeg hydro-electric system for June, shows that the revenue for the month was $82,639.91 and the expenditure $89,230.03, showing a deficit of $6,590.12. The total for the first six months of the year, however, shows a surplus of $30,925 19.

PHILLIPS' CABLES

as supplied to the Toronto Hydro Electric System





These illustrations show cross sections in the original size of cables recently supplied to the T. H. E. System and reordered by them for further extensions. The specifications are as follows.—Conductors composed of 37 strands each, .082 in. diameter. Thickness of dielectric on each conductor, .210 in. Thickness in belt, .210 in. Thickness of lead sheath, .160 in. Overall diameter, 2.61 in., 250,000 C.M. Three Conductor, Paper Insulated, and plain Lead Covered Cable for 13,200 volts. We can supply you with wires and cables of any size for Power, Lighting, Telephone, Telegraph, etc.

Write us for detailed information.

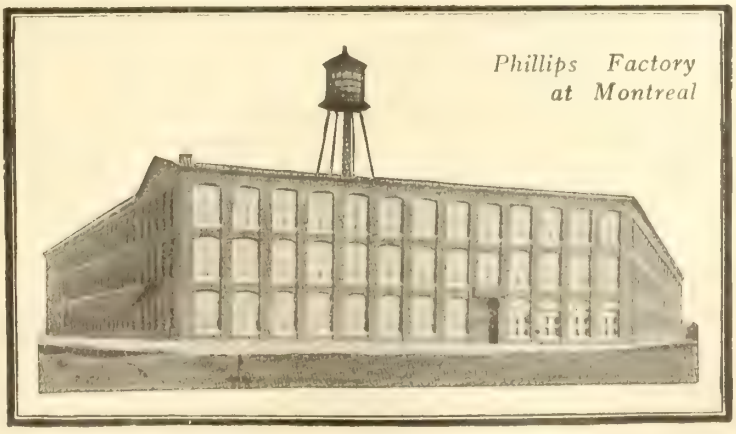
NOTE.—Specification of cable in left-hand cut: 3/0 B. and S. Three conductor. Each conductor 19 strands, each .094 in. diam. Thickness of dielectric on each conductor, .21 in. Thickness of dielectric on belt, .21 in. Thickness of lead sheath, .15 in. Overall diameter, 2.60.

Specification of cable in right-hand cut: As stated in copy.

Eugene F. Phillips Electrical Works, Ltd.

Head Office and Factory: MONTREAL

Branches: Toronto Winnipeg Regina Calgary Vancouver



Phillips Factory at Montreal

Transformers For Sale

[illegible] 16-17

Wagner Motor For Sale

[illegible] 17-17 Listowel Public Utilities Commission.

POSITIONS VACANT

[illegible] 12 t.f.

[illegible] 16-18

WANTED
Competent Electrical Wiremen

[illegible] Good Wages, Ideal Conditions.

Apply Gutta Percha & Rubber, Limited,
130 O'Hara Avenue,
15-18 Toronto, Ont.

Electric Generator For Sale

A 275 K.W. compound wound Railway Generator, manufactured by Bruce Peebles, England. Just received, and has never been used. At normal speed 550 volts at no load, 600 volts at full load. Twin machine to one that has been used by the advertiser, and has given absolute satisfaction for several years. Full specification furnished on request. Was contracted for before the war and price should be very attractive. Address, Moose Jaw Electric Railway Co., Ltd., Booth Building, Ottawa, Ontario. 17-17

Relation of the Electric Vehicle to the Transportation Problem

"Undoubtedly the electric vehicle promises to play a large part in the solution also of our stupendous terminal problems. Formerly our terminal problems were considered as local problems, whereas today they are national problems of the greatest importance. The port of New York cannot liberate itself with sufficient rapidity from existing conditions. We have the streets filled with horse trucks, and inefficient methods of getting materials away from the terminals. There is a clinker on the grates of the transportation problem, and we must devise means of getting rid of that so as to keep a lively draft and keep up the circulation. In my judgment, looking at it in its broadest aspect, I believe that the key to the solution of this and the clearing up of the terminal condition, lies in the electric vehicle."—Past President Lieb, of the N.E.L.A.

PETRIE'S LIST
of New and Used
MOTORS

FOR IMMEDIATE DELIVERY

No.	H.P.	Phase	Cycle	Volts	Speed	Maker
1	100	3	25	550	480	Westg.
1	40	3	25	550	750	C. G. E.
1	35	3	25	550	720	Westg.
1	30	3	25	550	1500	T. & H.
1	30	2	60	220	1500	T. & H.
1	25	2	60	220	945	Westg.
1	25	3	60	2000	900	C. G. E.
1	20	3	25	550	1440	J. & M.
2	10	3	25	550	720	Westg.
1	7½	3	25	550	750	C. G. E.
1	5	3	25	550	1500	C. G. E.
1	3	3	25	550	1500	C. G. E.
3	3	3	25	550	1400	Excelsior
1	¼	1	60	110	3400	Diehl.
1	¼	3	25	550	1500	T. & H.

Write Us for Prices

H. W. PETRIE, Limited
Front St. West - Toronto, Ont.



Rubber Covered Wires and Cables
FOR POWER, LIGHT AND TELEPHONE WORK

Incandescent Lamp Cord, Flexible Switchboard Cables, Special Cords and Cables for all kinds of Electrical Work.

Prompt Shipments from Canadian Factory.

BOSTON INSULATED WIRE & CABLE CO., Limited
Canadian Office and Factory, HAMILTON, ONT.

FOR SALE

1—50 H.P. 3 Phase, 25 Cycle, 2,200 Volt, 750 R. P. M. Canadian General Electric Motor. Complete with pulley, rail-base and oil immersed auto-starter equipped with "No Voltage" release; also 1, 30 ampere, 2,500 volt. Oil switch equipped with "Overload" trip and one potential transformer. Immediate delivery.

The FISHER ELECTRIC CO.
43 Britain Street, TORONTO

Tenders

A few dollars spent in advertising your proposals in

The Contract Record

would result in additional competition, which might save your city or town or your client many hundreds of dollars.

Motors, Generators, Transformers

New and Used for Immediate Delivery

MOTORS

25 cycle, 3 phase

No.	H.P.	Volt	Speed	Make
1	125	2200	500	C.G.E.
1	100	550	720	Westg.
1	75	550	500	Westg.
1	50	550	720	Westg.
1	40	550	720	Westg.
1	25	550	720	C. G. E.
1	15	550	720	C. G. E.
1	10	550	720	C. G. E.
1	125	220/440	375	Westg.
1	100	220/440	500	Westg.
1	75	220/440	500	Westg.
1	50	220/440	500	Westg.
1	30	220/440	500	Westg.
1	20	220/440	500	Westg.

60 Cycle, 3 Phase

No.	H.P.	Volt	Speed	Make
1	200	2200	600	Westg.
1	150	2200	600	C. G. E.
1	100	2200	600	C. G. E.
1	75	550	900	C. G. E.
1	50	550	900	C. G. E.
1	30	550	900	C. G. E.
1	40	220	900	Westg.
1	20	220	1200	C. G. E.

GENERATORS

60 Cycle, 3 Phase

No.	K.V.A.	Volt	Speed	Make
1	600	2200	225	C. G. E.
1	300	2200	600	A. C. B.
1	150	2200	600	C. G. E.
1	125	240	900	C. G. E.
1	75	240	900	C. G. E.
1	75	2200	900	Westg.
1	50	550	1200	C. G. E.

Direct Current

No.	K.W.	Volt	Speed	Make
1	500	250	300	Westg.
1	300	250	300	Westg.
1	150	250	500	C. G. E.
1	85	250	750	Westg.
1	35	250	300	C. G. E.
2	20	125	500	Westg.
1	17	125	1100	Westg.
1	12	125	1100	Westg.
1	7½	125	1100	Westg.
1	5	125	1200	C. G. E.
1	40	125	300	Westg.
	(Direct connected to engine)			
1	150	110/220	500	C. G. E.
	(Direct connected to engine)			

TRANSFORMERS

25 Cycle, S.P.

No.	K.V.A.	Volt
3	100	13200-6600/2200
3	10	550- 110/220

60 Cycle, S.P.

No.	K.V.A.	Volt
2	60	10000-2200
2	75	2200-110/220
2	50	2200-110/220
2	40	2200-110/220
2	10	2200-550
2	10	2200-110/220

AIR RECEIVERS

2 -2 ft. x 5 ft. ¼ inch plate. (New).
Pressure 150 lbs.

Direct Connected PUMPS

1,000 to 5,000 gal.
Motors, 60 cycle, 220 volt, 3 phase, complete sets

DIRECT CONNECTED SETS

2—450 K.V.A., 25 cycle, 550 volt, 3 phase, Westinghouse Generator, direct connected to Cross Compound Engines. Complete with switchboards, exciters, condensers, etc.
1—250 K.V.A., 25 cycle, 2200 volt, 3 phase, Westinghouse Generator, direct connected to Cross Compound Engine. Complete equipment.
1—5 H.P., 25 cycle, 550 volt, 3 phase, 1500 R.P.M., Lincoln motor, direct connected to 5 K.W., 125 volt, direct current generator.

Write or wire for full particulars and send list of equipment for sale.

GUELPH **A. E. LOWRY** **CANADA**

Selections from Our Stock of Motors

3 Phase, 60 and 25 Cycles

3 PHASE, 60 CYCLE MOTORS

Qu.	H.P.	Make	Volts	Type	Speed
1	¼	R&M	NEW. 110		1700
1	½	G.E.	NEW.. 110	KT	1800
1	½	G.E.	 110	I	1800
5	1	G.E.	NEW . 220	KT	1800
1	1	Fbks. M.	... 440	B	1200
4	3	Wstgh. New.	220	CS	1130
2	3	R&M	NEW. 220		1150
2	3	G.E.	 220	KT	1800
1	3	G.E.	220	KT	900
3	3	G.E.	 220	KT	1200
1	3	Cr. Wh.	 220		1720
3	5	Cr. Wh.	... 220	Q	1720
1	5	Cr. Wh.	... 550	Q	1720
1	5	Wstgh.	 220	CCL	1700
8	5	Wstgh. New.	220	CCL	1700
53	7	G.E. (motors only)	 550		1200
1	7½-15	Cr. Wh.	220/440		865/1735
2	7½	G.E.	NEW . 220	KT	1800
1	7½	G.E.	NEW .220	KT	1200
6	7½	G.E. (motors only)	 550	KT	1800
2	7½	G.E.	NEW . 220	KT	900
2	10	G.E.	NEW . 220	KT	1800
1	10	Wstgh.	 220	CCL	1700
1	10	Wstgh.	 220	CS	1150
1	10	Cr. Wh. with resistance type starter	550	Q	1800
1	10	G.E.	 220	L	1200
1	10	Robbins & M	220	K	1750
1	15	Wagner New motor only	.. 440		1165
2	15	Wstgh. New.	440	CS	1155
1	15	G..E.	 220	I	900
1	15	Wstgh.	 220		1155
2	15	G.E.	NEW . 220	KT	900
2	15	Fbks. M.	220/440	KBV	1200
2	20	Wstgh.	 220	CS	1160
50	20	Fbks. M.	220/440	KBV	1200
13	25	Wagner..	220/440	KBV	1200
2	30	Wagner New	220		850
1	35	G.E.	 220	KT	600
1	35	Triumph.	220/440		900
1	40	Wagner NEW .	220/440	BP	850
1	40	Fbks. M.	 220		900
1	35	G.E. NEW .	220	M	900
1	35	Westgh.	 220		1170
1	40	Westgh. New	220	CS	870
1	50	Westgh.	 220		860
1	50	Triumph	 220		720
1	50	Allis-Chal.	. 220		1750
1	75	Allis-Chal.	. 550		690
1	75	Westgh. New	440	CS	720
1	100	Allis-Ch.	. . 550		690
1	100	G.E.	 550	K	600
1	100	G.E. NEW .	550	M	600
1	100	Westgh.	 440		1200
1	125	G.E.	 220	L	600
1	150	G.E. NEW .	220	M	580

3 PHASE, 25 CYCLE MOTORS

Qu.	H.P.	Make	Volts	Type	Speed
2	5	Wstgh.	 220	CCL	705
1	10	Wstgh. New.	220	CS	750
1	12½	G.E.elev.type-high torque	220	KTE	750
15	15	Allis-Ch.	. . 220		750
7	20	Allis-Ch.	.. 220		750
1	40	Wstgh.	. . 220	MW	695
1	50	Allis-Ch. intermittent duty, sl. rg. drum controller	 440		500
1	55	Wstgh.sl.rg. 30 cycles, complete.	. 440		860
1	60/45/30	G.E.	440		500/375/250

GEORGE SACHSENMAIER & CO.

Office and Salesrooms: 141-43-45 N. Third Street.
Warehouses: 928-30-32 N. Third Street,

PHILADELPHIA

FOR SALE

Immediate Delivery

4—300 H.P., 200 lb. pressure water tube "Atlas" Canada Foundry boilers.
4—201 H.P., 160 lb. Babcock & Wilcox water tube boilers.
1—Feed water treating tank.
5—Boiler feed pumps.
1—Wainwright feed water heater.
3—Jet Condensers.
1—1,000 H.P., 98 R.P.M., 24 inch x 36 inch x 46 inch Inglis Vertical Cross Compound Condensing Engine.
1—Canada Foundry Triplex Pump, motor driven, 300 gallons per minute; cylinders 8 inch x 12 inch.
1—Traveling Crane, 35 foot span.
2—150 K.W., 250 volt, D.C. Generators, direct connected to Peerless self-oiling automatic engines, 125 lbs. working pressure, 230 R.P.M.
2—400 K.W., 250 volt, 300 R.P.M., belted Compound D.C. Generators, C.G.E.
4—200 K.W., 360 R.P.M., single phase, 60 cycle, 2200 volt, C.G.E. A.C. Generators.
Quantity of 52 inch belting, idlers, and various boiler and engine room accessories.
Piping, Valves, Fittings, etc.
180—Type H, C.G.E. 2200/220/110, 60 cycle line transformers, sizes 1 K.W. to 15 K.W.
2000—Poles in various lengths, 60 ft. to 20 ft. Crossarms, brackets, insulators, etc.
Quantity of No. 6 weatherproof wire.
1500—Watthour meters, 110/220 volt, 60 cycle, and 250 volt D.C. Ferranti and C.G.E. Various sizes from 5 amp. to 150 amp
10—D.C. motors, 500 volt, 1 H.P. to 20 H.P.

Miscellaneous lot of general equipment used in connection with the generation, distribution and sale of electric power.

Call or address—

C. T. BARNES, Manager

London Electric Co.

Richmond St., LONDON, Ont.

Wagner Distributing Transformers

Do not consider one feature alone in the purchase of Distributing Transformers.

Wagner Transformers combine the best characteristics to provide a dependable economic unit.

May we send Bulletin 10513?

Wagner Electric Manufacturing Company
of Canada Limited-Montreal

Power Bldg., Montreal. 347 Adelaide St. W., Toronto

424

If a Brush Absolutely Refuses To Spark!

is that not a very good reason for fitting it on your motor generators and commutators?

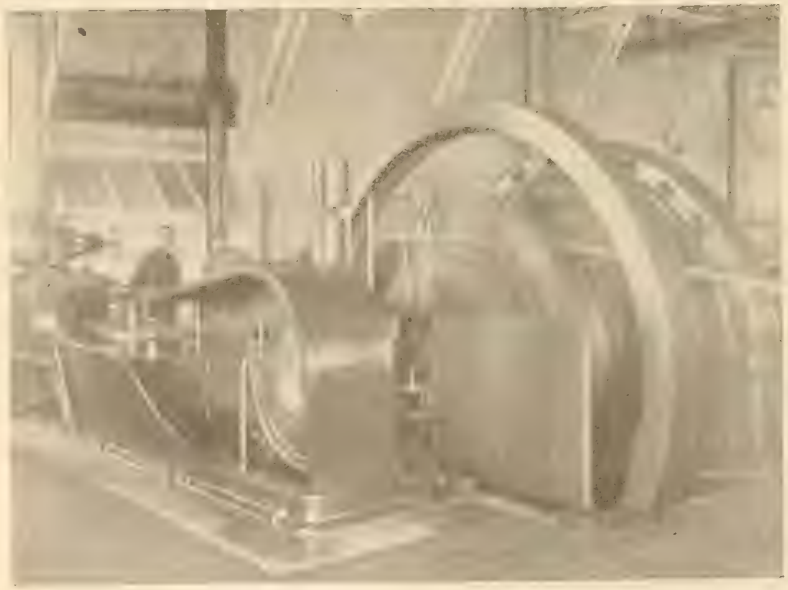
No-Spark Carbon Brushes

wear longer because they are frictionless and self-lubricating. The remarkable economy of these brushes will appeal to you. They have often outlasted the ordinary brushes 8 to 12 times over.

Write for our latest bulletin.

CALEBAUGH
Self-Lubricating Carbon Co.
1503 Columbia Ave., PHILADELPHIA, Pa.

25 Cycle Engine Generator Sets For Sale



These units were in use only—300 K.W. three months, and 250 K.W. seven months, and are in first class condition.

1—250 KW.
1—300 KW.

25 Cycle, 3 Phase, Westinghouse Generators, Direct Connected to McIntosh & Seymour Cross Compound Gridiron Valve Engines, 150 R.P.M.

1—60 K.W., 60 Cycle, 3 Phase, 2300 Volt Generator

1—100 K.W., 25 Cycle, Motor Generator Set

1—100 K.W. Direct Current Engine Generator Set

1—12 x 24 x 30 Wheelock Tandem Compound Engine

Write for further particulars and quotations

Power Plant Equipment Co., Dominion Bank Bldg. **Toronto, Ont.**

CANADIAN PORCELAIN CO.

LIMITED

HAMILTON - CANADA

Manufacturers of High and Low Tension Porcelain Insulators

Hydro Electric Equipment For Sale

3—350 KVA., 2300 volt, 3 phase, 60 cycle, 360 r.p.m., rotating field Vertical A.C. generators with two guide bearings but no thrust bearings, 40-degree continuous operation, 25 per cent overload for 24 hours, 50 degree rise.

3—15 K.W., 125 volt, 360 r.p.m., 4 poles, No. 10 SV frame, type "S" D.C. generators, vertical type, for excitation of above A.C. machines.

1—Four-panel switchboard with Tirrill regulator for control of above three A.C. generators and one feeder circuit. All of the above electrical machinery is of Westinghouse manufacture.

3—Trump pattern water turbines, vertical type, of 454 H.P., each under not less than 50 feet head, at that head using 6,000 cubic feet of water per minute, with an efficiency of 80 per cent. Also 3 cast iron heads with trash racks, 3 sections of 50 in.—¼ in. steel pipe between turbines and gate valve, 3 sections 50 in.—¼ in. steel pipe between trash rack and gate valve. 3—draft tubes 5 ft. long and 45 in. diameter.

3—Woodward Compensating governors for water turbines.

3—50 in. gate valves with bronze screw, nut, bronze seat and bronze face on valve where it comes in contact with seat, equipped with by-pass valve.

These turbine wheels and connections manufactured by the Pratt Iron Works, Akron, Ohio :: ::

Dominion Iron and Wrecking Co., Ltd.

Head Office : Transportation Building **Montreal, Que.**

Railway & Power Engineering Corporation, Limited

MONTREAL
Power Bldg.—Tel. Main 5667

Head Office—TORONTO

TORONTO
Can. Pac. Ry. Bldg.—Tel. Adelaide 2675

USED EQUIPMENT

Motors

3 PHASE—25 CYCLE

No.	H.P.	Make	Type	Volt	R.P.M.
1	1200	G. E.	I.P.	2080	250
2	750	West.		220	292
1	275	G. E.	Syn.	6600	275

3 PHASE—60 CYCLE

No.	H.P.	Make	Type	Volt	R.P.M.
1	1000	West.	H.F.	2200	360
1	300	G. E.	ATL	2300	225
1	300	A. C.	ANY	2200	505
3	250	Burke	Ind.	6600/2200	514
1	500	West.	C.S.	2200	1150

Transformers

25 CYCLE

3—375 K.V.A., 1 ph., 13200/6600-440/220 G. E.
3—100 K.V.A., 1 ph., 13200/6600-2200 G. E.

60 CYCLE

3—670 K.V.A., 1 ph., 2300/60-70-90-105 G. E.
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1—100 K.V.A., 60 cycle, 2200 volt, 900 R.P.M. Ft. Wagner.
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1—300 KW., 600 volt, 160 R.P.M. Westinghouse Rly. Generator complete.
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1—150 KW., 550 volt, Type M, 575 R.P.M. Westinghouse Generator.
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Engine Generator Sets

ALTERNATING CURRENT

1—450 KW., G.E., 2300 volt, 3 phase, 60 cycle, 100 R.P.M., direct connected to Allis cross compound Engine, complete with Wheeler condenser and feed water heaters.

1—600 KW., West. Alternator, 2300 volt, 3 phase, 60 cycle, direct connected to West. cross compound Engine.

1—700 KW. Ditto, direct connected to gas Engine.

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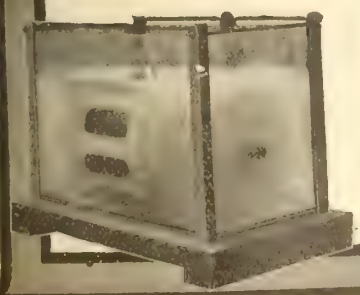
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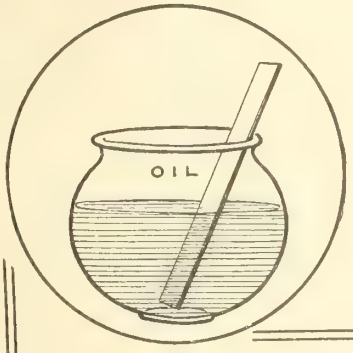
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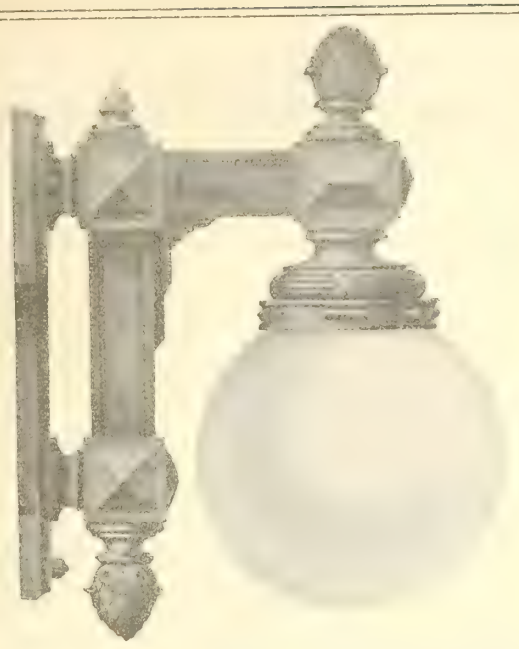
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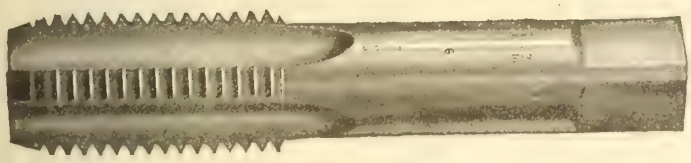
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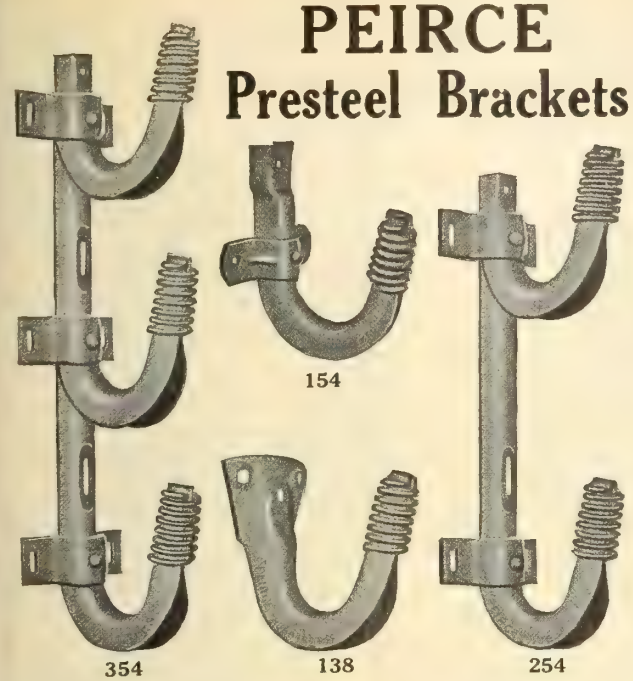
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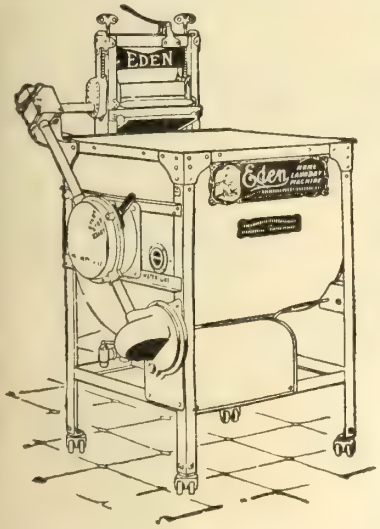


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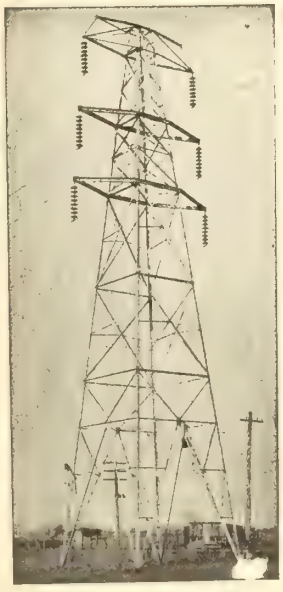
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BOXES (Manhole)
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Canadian General Electric Company
Joyner, Limited, A. H. Winter
Pringle, R. E. T., Ltd.

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Sundh Electric Company

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Moloney Electric Company of Canada

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Canada Wire & Cable Company
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Northern Electric Company
Phillips Electrical Works, Eugene F.
Standard Underground Cable Company of Canada, Limited.

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Northern Electric Company
Standard Underground Cable Company of Canada, Limited.
Steel City Electric Company

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Calebaugh Self Lubricating Carbon Co.

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Ohio Brass Company

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Jones & Glassco

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Canadian General Electric Company
Lincoln Electric Company of Canada
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CHRISTMAS TREE OUTFITS
Northern Electric Company

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National Metal Molding Company
Northern Aluminum Company

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Conduits Company
Flexible Conduit Company
National Metal Molding Company
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Orpen Conduit Company

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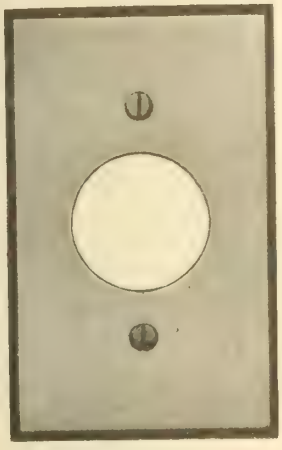
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Chicago Fuse Manufacturing Company
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Detroit Fuse & Manufacturing Company
Economy Fuse & Manufacturing Company
G. & W. Electric Specialty Company
Hatheway & Knott, Inc.
Moloney Electric Company of Canada
Northern Electric Company
Square D Company

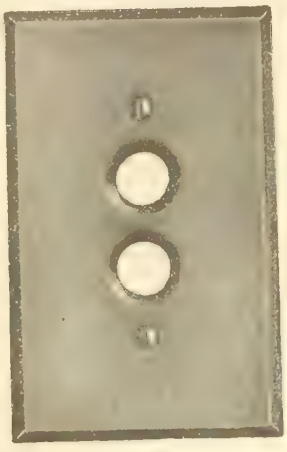
(Continued on page 54)

How about that Fall Order for SWITCH PLATES?

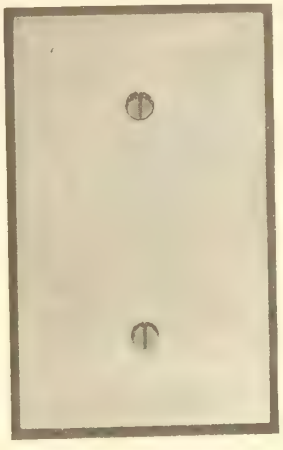
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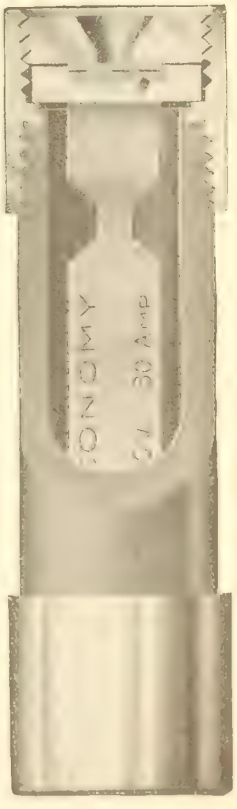
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Write for Catalog 20

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Mica Company of Canada

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Canadian Westinghouse Company
Canadian Vickers
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Northern Electric Company
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(Continued on Page 56)

OPEN TANK TREATED

British Columbia Cedar Poles

will double the life of your pole lines. Our treating plant at Nakusp, B.C., uses either Creosote or Carbolineum as you prefer.

Information and prices without obligation of any sort from our nearest office.

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We have just Completed a New Wiring Device Catalogue No. 6

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The Duncan Electrical Company, Limited

1665 St. James St. - MONTREAL, QUE.

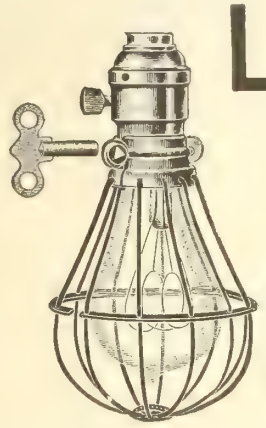
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LAMPS Locked On Can't Get Stolen

They can't get knocked out or broken.



LOXON

guards give your lamps just such protection.

Sold at a popular price. Our Loxon Lamp Guards and other Specialties demand the attention of every handler of Electrical Goods.

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ELECTRICAL PORCELAIN

Solid Knobs, Split Knobs, Cleats, Tubes, and special Porcelain of all kinds.



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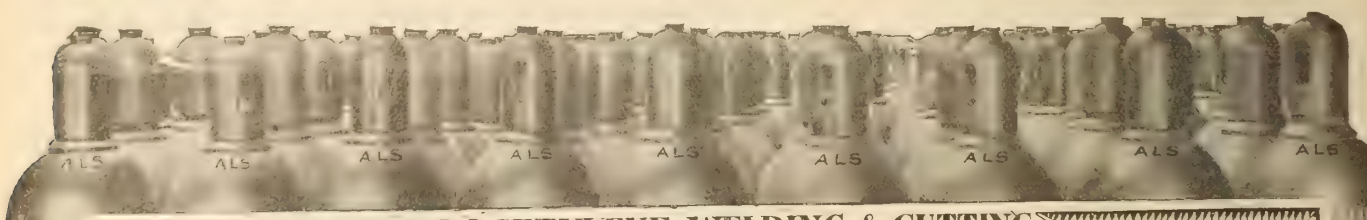
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Over 80% of the material that appears to be only fit for scrap can be used over again practically equal to new by welding the parts together by the Oxy-Acetylene Process.

This not only means saving the actual cash value of the material reclaimed, but relieves the situation brought about by the excessive demand for metals of every description.

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The Pioneers of the Process throughout the World

TORONTO MONTREAL WINNIPEG HALIFAX

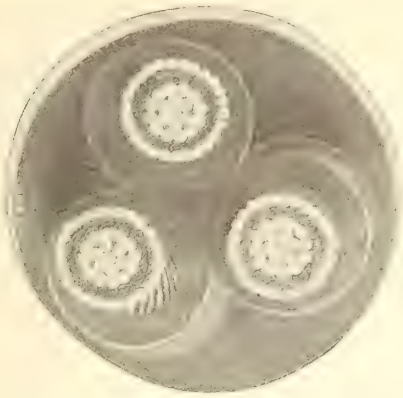
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SECOND HAND

No.	H.P.	Phase	Speed	Volts	Cycles	Starter	Make
1	50	3	750	550	25	yes	C.G.E.
1	60	3	750	550	25	yes	Crocker Wheeler
2	50	3	750	220	25	yes	Lincoln
1	25	3	750	220	25	yes	Lincoln
1	25	3	750	220	25	yes	C. G. E.
1	15	3	1500	220	25	yes	T.H.E.
1	10	3	1500	220	25	yes	T.H.E.
2	5	3	750	550	25		Westgh. C.C.L.
2		1	1500	110 220	25		Century & Wagner
1		1	1800	110	60		Fort Wayne
1		1	1800	110	60		Westgh
1		1	1800	110	60		Fisher
1	40	2	900	220	60	yes	Fuller Wenstrom
1	15	2	1200	220	60	yes	C.G.E.
1	10	2	variable	220	60	no	Westgh.
2	10	2	1200	220	60	yes	Westgh. CCL.
1	15	2	1800	220	60		T.H.E.
1	7½	2	1200	220	60	yes	Crocker Wheeler
2	5	2 or 3	1800		60		Westg. CCL. rewd
2	5	2	1200	220	60	no	Westg. C.
2	5	2	1800	220	60	no	Westg. CCL.
2	1	2 or 3	1800		60	no	Westg. CCL. rewd.
1		2	1800	220	60	no	Westgh. CCL.
2	10	2 or 3	1200		60	no	Westg. CCL. rewd
1	3	3	1200	220	60	no	Westg. CCL.
2	3	3	1800	220	60	no	C.G.E. rewound
1	20	3	900	220	60	yes	Lincoln
1	7½	3	1800	220	60	yes	Lincoln

TRANSFORMERS

1 40 K.W. Type R60 2200-220 volts, Packard
2 75 K.W. Type H.G.60 1040/2080 115 230 volts C.G.E.
1 40 K.W. Type C 2200-220 volts, Westgh.

Toronto & Hamilton Electric Co.
99-103 McNab St. N., HAMILTON Limited



Paper-Insulated, Lead Covered Cable with Split Conductors.

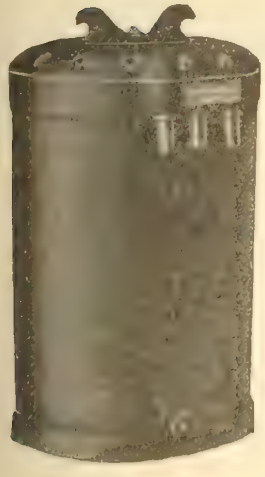
THE Recognized Superiority of STANDARD Electric Wires, Cables and Cable Accessories among those who have used them is due to persistent and successful efforts during 35 years of manufacturing experience in the United States to make them *standard* in quality as well as in name. Ask a user.

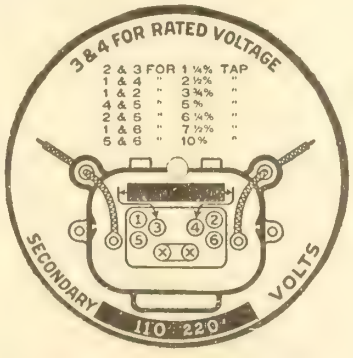
Standard Underground Cable Co.
of Canada, Limited
HAMILTON - ONT.
Montreal Toronto Hamilton Seattle

Moloney Service Transformers

are all supplied with brass plates fastened on the inside of the cover of each transformer; all connections marked plainly. They do not get covered with dirt or stained with oil like a blue print does. You always have them before you when changing taps. Heavy bushings eliminate breakages in shipment and handling

Moloney Transformers are manufactured in a factory that was built especially for that purpose only. They are designed by Engineers and built by men who make a specialty of this work.







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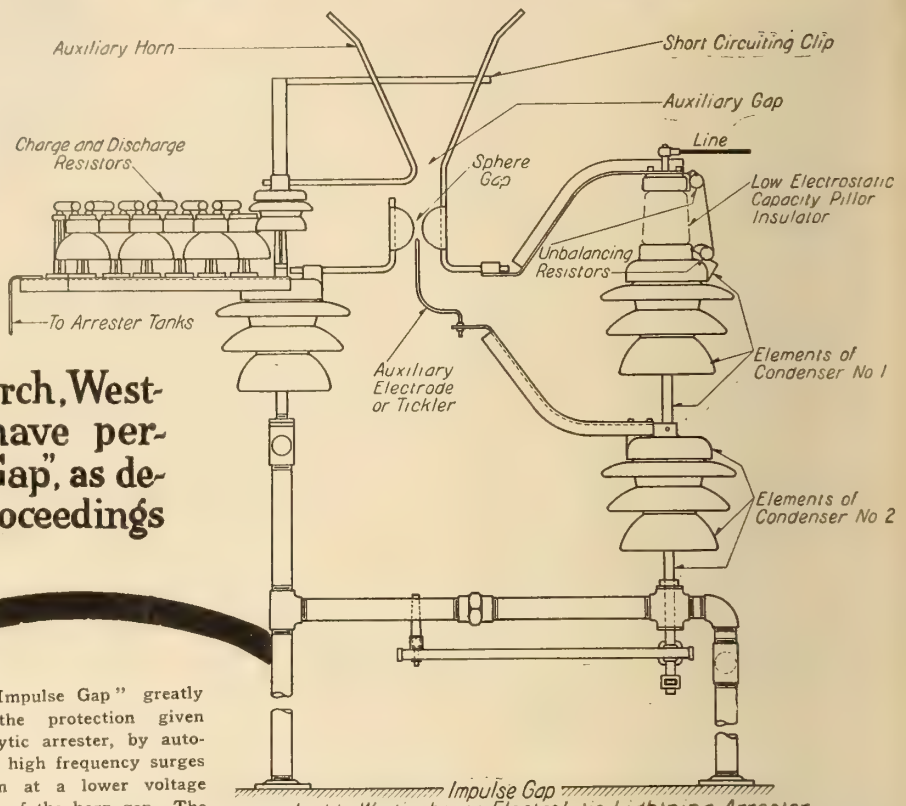
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Windsor, Ont.

Head Sales Office
Bank of Hamilton Bldg., Toronto

Branch Offices
Montreal, Halifax, Winnipeg, Vancouver

The Impulse Gap

The greatest advance in protection from lightning since the electrolytic arrester was invented.



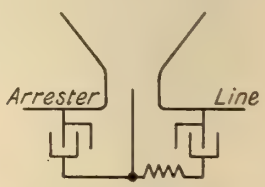
Impulse Gap as applied to Westinghouse Electrolytic Lightning Arrester.

After exhaustive research, Westinghouse engineers have perfected "The Impulse Gap", as described in the May proceedings of the A.I.E.E.

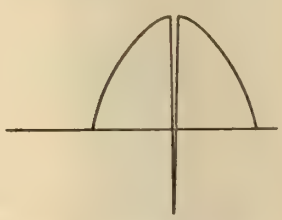
The "Impulse Gap" greatly increases the protection given by an electrolytic arrester, by automatically selecting high frequency surges and discharging them at a lower voltage than the normal setting of the horn gap. The high frequency discharge voltage may be as low as 2/3, or even 1/3, of the normal frequency value. It is thus possible to use a gap setting that will ensure against too frequent discharging, on minor surges of normal frequency, yet which will give any desired degree of protection against really dangerous surges. It is the only device that will protect insulation between turns against a steep wave front surge of reversed potential, i.e., a sudden drop in voltage.

Through the use of standard porcelain insulators as condensers, only a minor mechanical modification of existing designs has been necessary.

The "Impulse Gap" uses a circuit that is balanced as to voltage, at normal frequency, but becomes unbalanced and starts a discharge in the case of any high frequency surge. At normal frequency there is no difference of potential between the mid point of the condensers and the auxiliary electrode midway between the horns. A high frequency, however, passes freely through the condensers and piles up its full voltage across the resistance, that is, across one-half of the total gap, which, therefore, breaks down, causing the entire gap to discharge. The arc then rises on the horns and is dissipated as usual.



Wiring Diagram of Impulse Gap Connections.



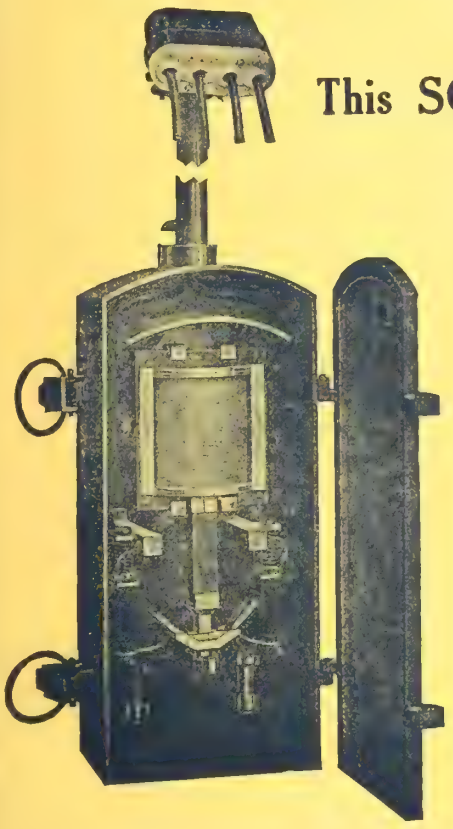
Static Impulse Superimposed on Voltage Wave in Opposite Direction.

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XVII No. 18 Toronto, September 15, 1918

Electrical News

Generation, Transmission and Application of Electricity

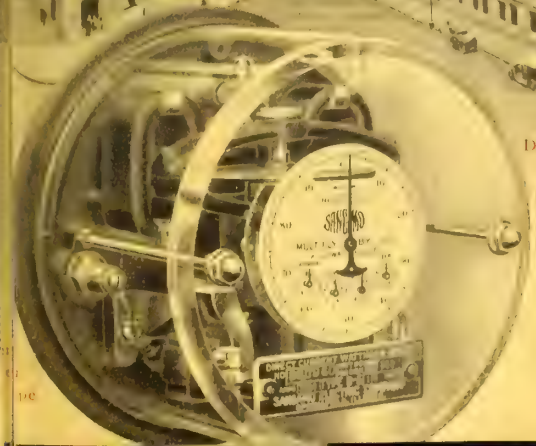


THE METHODIST BOOK BUILDING
Eighteen Sangamo meters of varying capacities (100 to 1200 amps.) are used, by the Toronto Hydro-Electric System to measure the power supplied, and by the customer on his switchboard to measure power generated, also in every department to record consumption of each department.



C.P.R. BUILDING
Toronto Headquarters of the C. P. R. Co. Sangamo meters measure all the power generated in the building plant and record distribution on various floors.



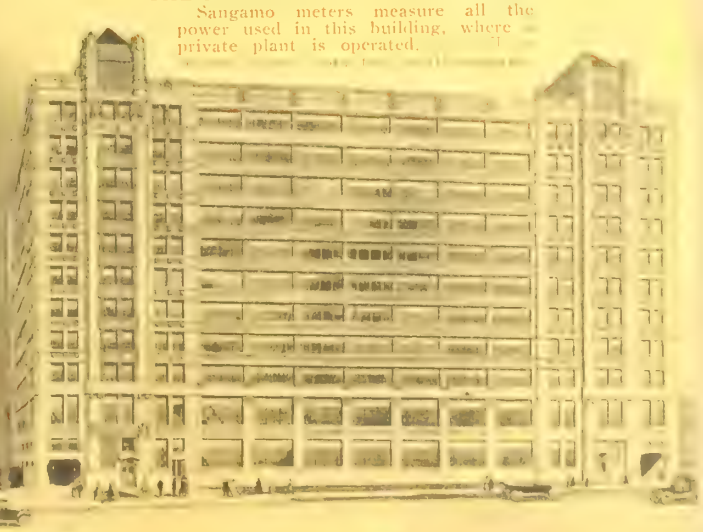


DOMINION BANK BUILDING
Head Office of the Dominion Bank of Canada. Sangamo meters measure both the Toronto Electric Light Company's supply and the power generated in the building's own plant.

Canada thinks well of Sangamo

With thousands of central stations, great buildings and mighty industries in the United States Sangamo equipment throughout, and with such installation as the 60,000 ampere meter at Niagara Falls—the largest load ever carried on a single meter—the superiority of Sangamo products is well established. But this appreciation of Sangamo excellence does not stop at the "dividing line," as evidenced by the few Toronto installations shown here—They are representative of the class of Sangamo meter users throughout the Dominion. Canadians require proof of quality in service. Let us offer you some convincing proof.

THE SIMPSON MAIL ORDER BUILDING
Sangamo meters measure all the power used in this building, where private plant is operated.



Sangamo Electric Company of Canada, Limited

Northern Electric
"DUMORE" UTILITY MOTORS



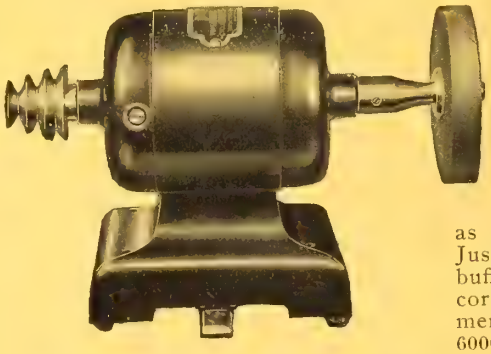
——are a boon to Housewives, and go a long way towards helping solve the servant problem by furnishing sufficient power to do light chores. "DUMORE" Utility Motors are small in size but capable of long, hard service in driving many domestic appliances, or with attachments for polishing silverware, cleaning cutlery, sharpening knives, etc., etc.

TYPE "A" 1 25 H.P.

Built to meet the demand for a light, compact power unit. Finished in black enamel. Equipped with 3 ft. of cord and attachment plug, wheel arbor and emery wheel. Wheel arbor nickel plated. Speed 2000 to 9000 R.P.M.

TYPE "B" 1/25 H.P.

The Type B Motor is the same as the Type A illustrated above, excepting that it is finished in all nickel plate. Equipped with 3 ft. of cord and attachment plug. Makes a very attractive looking motor for any use.



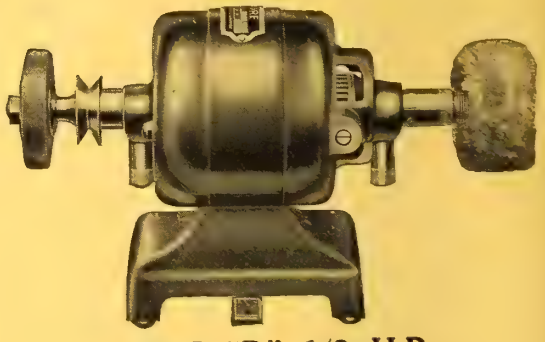
TYPE "C" 1/16 H.P.

Light and powerful. Always ready for use, and is as near trouble proof as it is possible to make a motor. Equipped regularly with 3-step pulley on one end of the motor shaft and a wheel arbor on the other, together with emery wheel. The Type "C" can be equipped the same as the Type "D" motor if so ordered. Just the motor for light polishing and buffing work. Equipped with 8 ft. of cord and attachment plug. Cutler-Hammer 3-speed Rheostat. Speeds 2000-6000-8000 R.P.M.

Practical—Efficient—Economical

For Jewelers, Dentists, Hotels and Restaurants the "DUMORE" Utility Motor will be found indispensable in a great many ways. Furnished in three sizes —"A"—1/25 H.P.; "C"—1/16 H.P., and "D"—⅛ H.P. For the benefit of the trade we have undertaken to advertise these famous "DUMORE" small motors to the public through the Daily Papers from coast to coast, and it will be to your distinct advantage to carry this line in stock for demonstration when called upon to do so.

For full particulars, prices and attractive literature, write our nearest house



TYPE "D" 1/8 H.P.

TThe Type "D" Motor is one of the most popular of stock sizes. Is especially adapted for jewelers' and dentists' work. Equipped with 8 ft. cord and attachment plug. Cutler-Hammer 3-speed Rheostat in the base. Shaft ends are tapered. Ritter chucks and wheel arbors can be used on this motor. Speeds 2000-6000-8000 R.P.M.

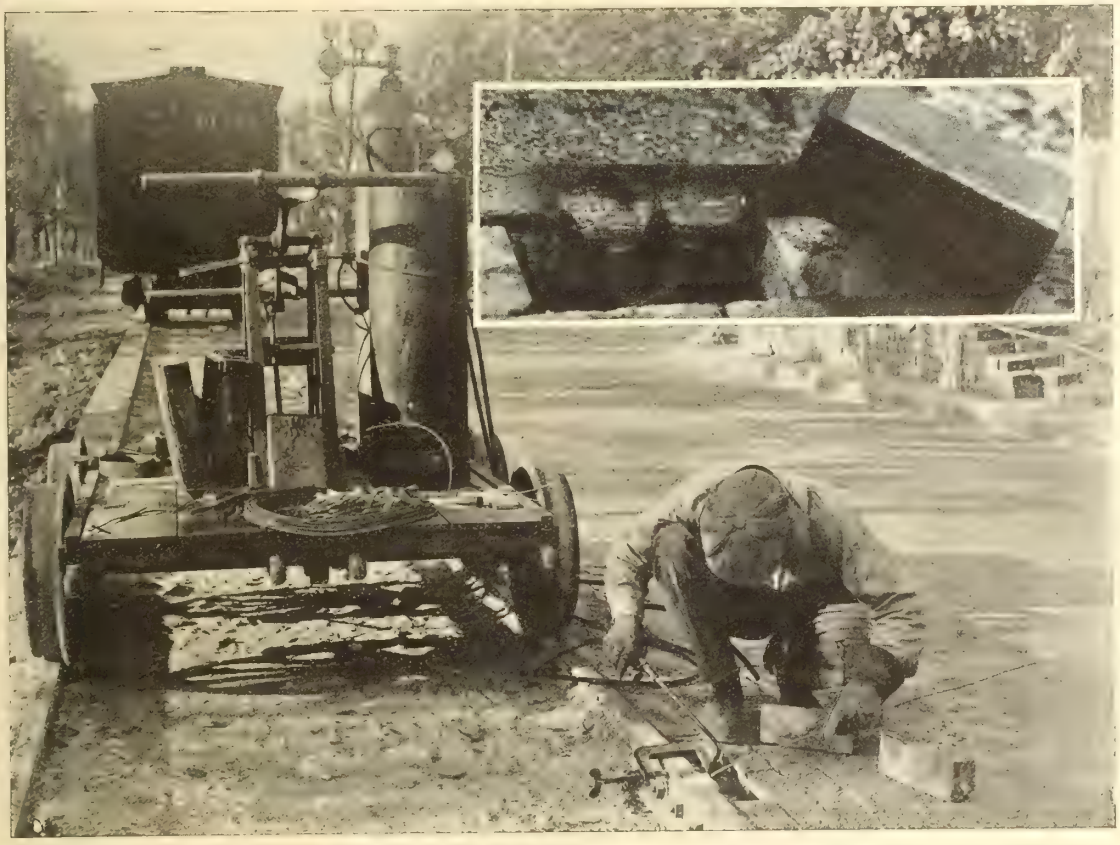
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Specify FLEXTUBE on your orders to your jobber, and insist that FLEX-TUBE be shipped. It will save you labor costs, material costs and bother of all kinds.

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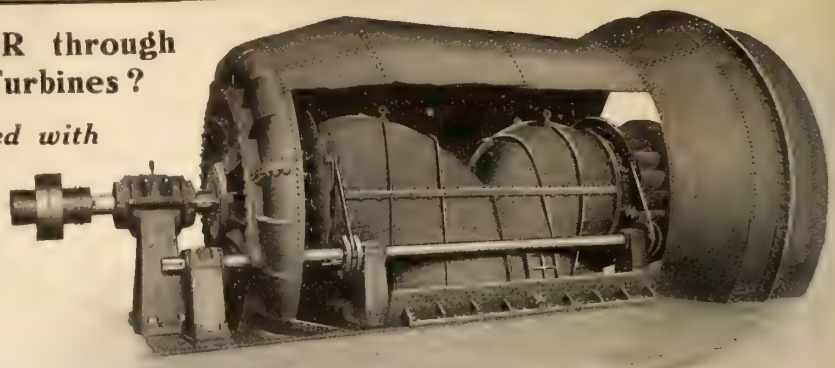
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furnished in
sheets, tubes, rods, granular, molding plastic, impregnating liquids.

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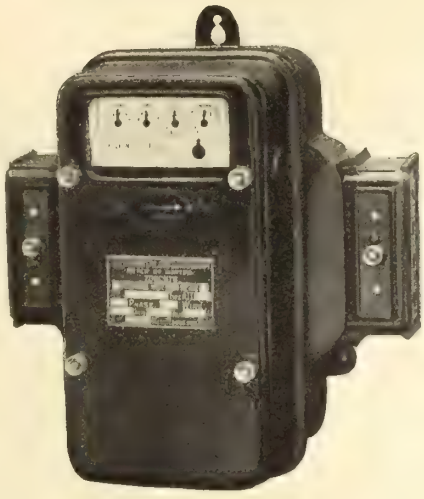
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This meter also has more inside room for the connections, and the three or four lines are carried straight through the meter from the left to right. In every respect this C. & H. Poly-Phase is a Safety Meter, and is undoubtedly the one to select for Installation on Long Distance Transmission.

C&H Poly-Phase The Safety Meter

The Company's guarantee goes with every instrument. The new Poly-Phase is as near perfect as it is possible for a meter to be.

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Useful in the Shop and Laboratory for the Measurement of Resistance
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The Type S Bridge is a thoroughly practical instrument for shop and field use. Being complete in every detail it is ready at all times for immediate use. It is easily portable, its weight being but 8 pounds. The precision of adjustment of its coils (Rheostat 1/10 per cent., Ratio 1/20 per cent.) insures accurate measurements. The galvanometer, the weakest element of such an instrument, is unusually rugged. It is a separate element and may be removed for examination or repair by taking out two screws. The battery is of the ordinary "flash light" type, and renewals may be procured practically everywhere. The price is $66.25 net, f.o.b. Philadelphia, boxed for shipment.

Bulletin No. 530 describes this instrument.

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Electrical Measuring Instruments

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The most perfect interior construction Conduit on the market.

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A high-class interior construction conduit of the enamelled type, proof against acid or other corrosive agents.

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The Fraser Patent Threadless Pipe Fitting

This fitting is a new device and saves a large percentage of the labor cost on installation of any pipe frame work, for switchboards, switch and bus structures, and greatly improves their appearance. This device is also ideal for Architectural and Marine use for pipe railings, etc.

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POLE LINE HARDWARE

That Stands the Test of Time and Weather

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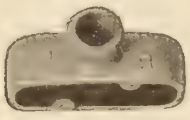
Wires (copper or galvanized), Bolts, Nuts, Rivets, Washers, Screws, Pole Steps, Guy Clamps and Crossarm Braces, etc.

CONDUIT PIPE FITTTINGS

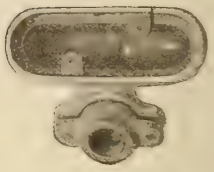
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TYPE A

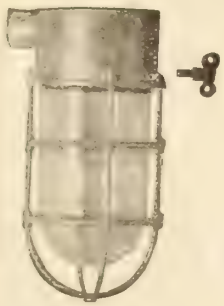


TYPE B



TYPE F

In introducing to the trade C.G.E. Conduit Pipe Fittings, we desire to call particular attention to the following points, in connection with their manufacture:



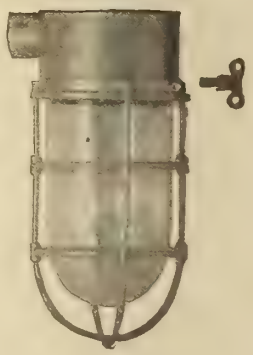
TYPE V
Vapour, Gas and Dust Proof

All C.G.E. Pipe Fittings are made of pure metal, carefully selected to ensure proper tapping and threading, well-japanned on the inside and electro-galvanized on the outside.

The cover openings are ground thoroughly flat and screw holes well centred.

All covers are fitted to castings before shipment, to avoid possible drilling error or extreme shrinkage of porcelain.

In general quality, high finish and uniformity of product, C.G.E. Fittings compare most favorably with any other make on the market.



TYPE VH
Vapour, Gas and Dust Proof.

Every shipment is warranted to maintain this high standard—samples will gladly be forwarded free of charge, on request.

C.G.E. Fittings comprise all standard types.

C.G.E. Fittings are approved by the National Board of Fire Underwriters and by the Hydro Electric Power Commission of Ontario.

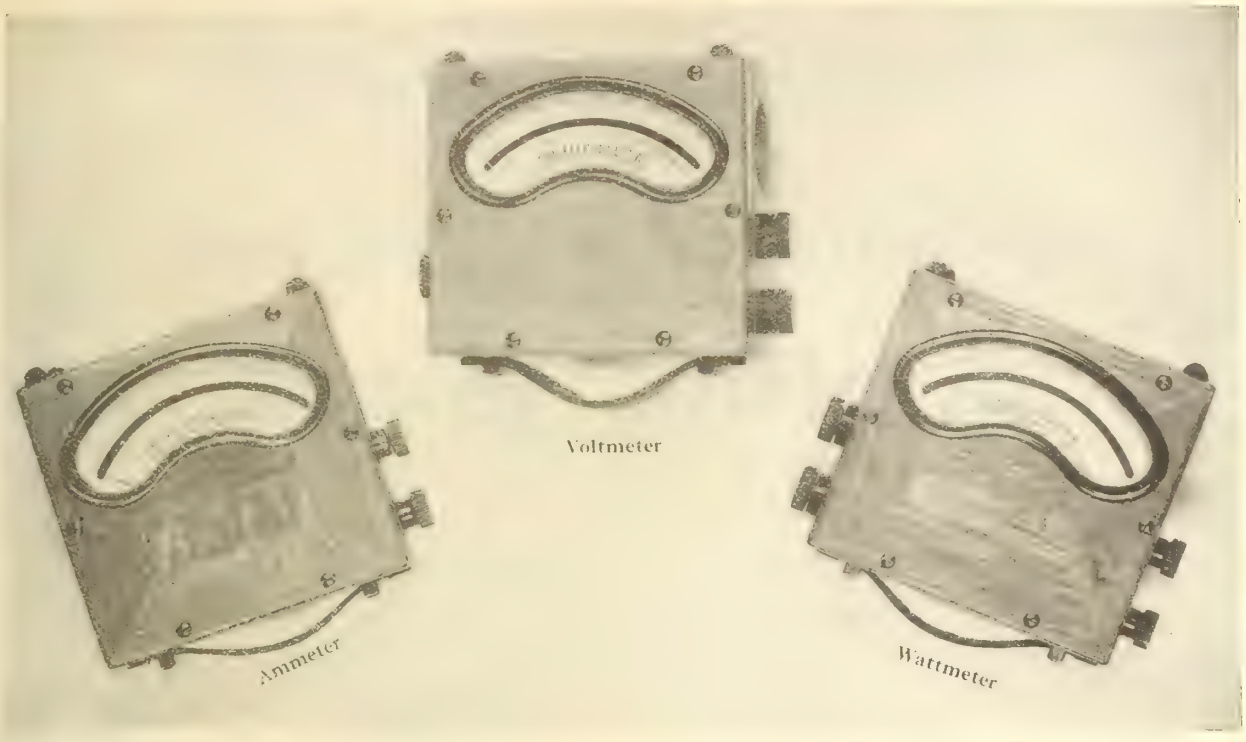
And they Cost Less Money!

Bulletin No. 618, describing these fittings, will be mailed on request to our nearest office.

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LIMITED

Head Office: Toronto. Sales Offices: Montreal, Quebec, Halifax, Sydney, Ottawa, Cobalt, South Porcupine, London, Winnipeg, Calgary, Edmonton, Nelson and Vancouver.



Type P-8 Portable Instruments

This is the smallest and lightest accurate set of portable ammeters, voltmeters, and wattmeters for A. C. and D. C. Service.

It is applicable to all commercial frequencies and wave forms without appreciable error and on direct current the accuracy is very high.

Each instrument weighs under 2 pounds. Dimensions are only $4\frac{3}{4}$ in. by $4\frac{3}{8}$ in. by $2\frac{9}{16}$ in.

The voltmeter and wattmeter are the dynamometer type. The ammeter is the iron vane type.

The windings are magnetically shielded and a new design air damper has been applied to facilitate quick readings.

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Standard Package Assortments

—OF—

Decorated and Etched

Illuminating Glassware

Illustrated in Catalogue No. 6

Selected from the best sellers in the line



In order to make it easy for our customers to *carry in stock* our Color Decorated and Etched Shades we have made up Standard Package Assortments of 6 dozen Shades—12 different designs—6 pieces of each



Also Standard cases containing 6 Decorated or Etched Bowls each one different

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Factory and Head Office: 388 Carlaw Ave., TORONTO
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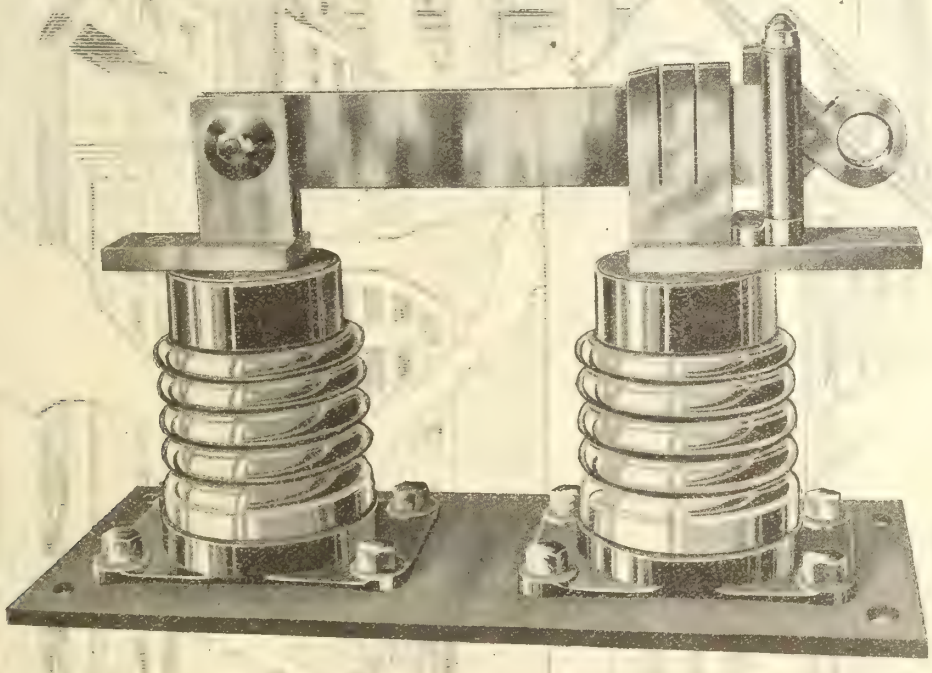
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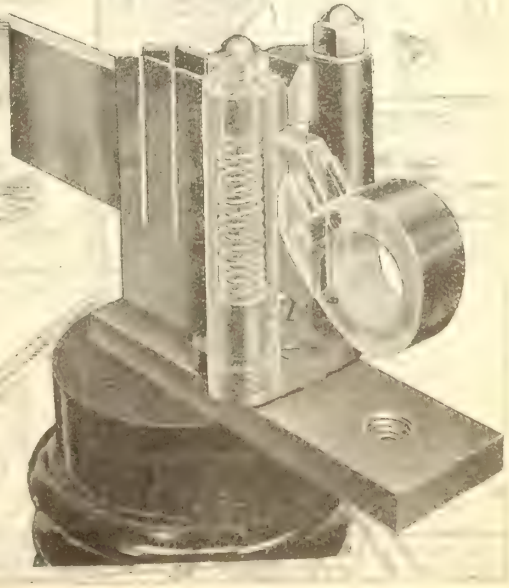
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effectively resists electrical expulsion strains



As electrical expulsion strains increase, the locking jaws are held closed proportionately tighter.

Easily opened from any angle with one pull, without special hook.

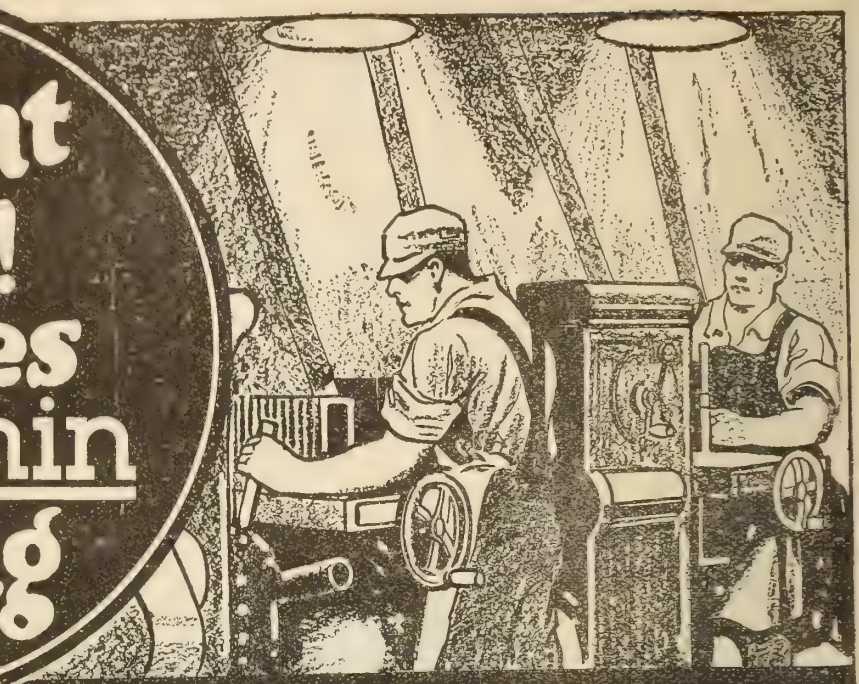
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132 South Eleventh Street
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Daylight Pays! So Does Benjamin Lighting





Shallow Bowl Reflector with Type "N" neck for any standard 2¼ inch shadeholder.



Deep Bowl Reflector with Type "B" holder for any standard brass socket.



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Benjamin
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YOUR best light, provided by the sun, costs you nothing. Benjamin light, which rivals the sun, costs you less than haphazard, taken-for-granted systems because it reduces spoilage and accident and increases production.

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Shade Holder Reflectors

are made for attachment to standard sockets and Benjamin Sockets. They comprise all necessary shapes for distribution needs. They include reflectors with porcelain enameled steel, aluminized steel and paint enameled steel surfaces.

You can fit Benjamin Reflectors to your present lighting system and get immediate results.

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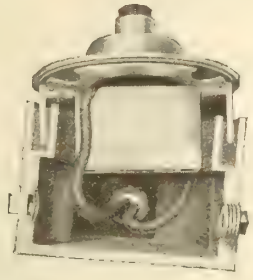
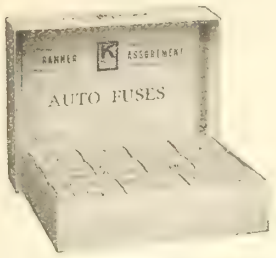


Fig. 104
Sectional view of No. 421 Outlet and No. 166 Nozzle with Bryant Receptacle No. 1363 and Plug No. 1110 mounted on lugs of Adjusting Ring.
Quarter Actual Size.

NO MORE BULLETINS
Our new complete catalog No. 33 just off the the press. Yours for the Asking.
"THE QUALITY LINE"

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"BANNER" ASSORTED CARTON



This is a small, compact, carton giving a very good assortment at low cost. It contains 100 glass tubing cartridge type fuses, assorted as follows:

30 No. 1AG—20 amp. 15 No. 3AG—15 amp. 5 No. 5AG—15 amp
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5 No. 3AG—10 amp. 10 No. 4AG—15 amp. Total List $7.00

The fuses in all Killark assorted cartons are packed in littl individual cartons, with contents clearly marked, preventing all possibility of error.

No charge is made for these cartons—the list prices represent the cost of the fuses only.

A POINT TO REMEMBER
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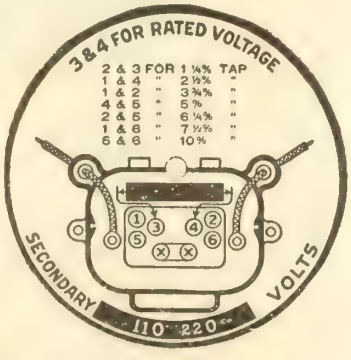
Moloney Service Transformers

are all supplied with brass plates fastened on the inside of the cover of each transformer; all connections marked plainly. They do not get covered with dirt or stained with oil like a blue print does. You always have them before you when changing taps. Heavy bushings eliminate breakages in shipment and handling

Moloney Transformers are manufactured in a factory that was built especially for that purpose only. They are designed by Engineers and built by men who make a specialty of this work.



Subway Type



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Are you interested in the remarkable development which has been going on in the

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The scope of our work enables us to supply practically standard breakers for special service. We submit that the circuit breaker art of the world is what we have made it. A search of the Patent Office records will prove this statement, or an easier way might be for you to look at any recent notable installation.

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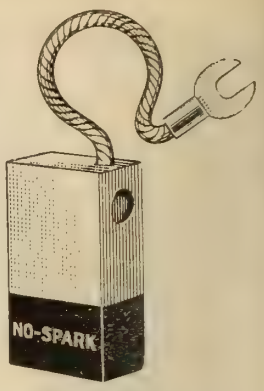
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CALEBAUGH
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The Erico Bond Welder

The combined weight of the rheostat and furnace, which comprise the equipment of the

Erico Portable

is approximately 200 pounds, which enables easy removal from tracks insuring no holdup of traffic.

The outfit installs the standard **ERICO** rail bond, allowing no flame or arc to strike either rail or bond.

The Rheostat is especially adapted for arc welding purposes of all kinds.

We will be pleased to furnish full particulars upon request in regard to our very efficient equipment.

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CLEVELAND, OHIO



Every Man From Factory Employee to Employer A Booster For The Motor Dealer

The reliable operation of R & M Motors enlists the goodwill of every man in the factory where they are used.

The owner who makes larger profits, the superintendent who finds it easier to maintain production schedules, the millwright whose upkeep worries are reduced, the machine laborer whose output and earnings are increased—all speak a good word for the motors which increase their efficiency and for the dealer who sells them.

This is one reason why dealers find R & M Motors easy, profitable sellers. Another reason is that the R & M Motor and its service reliability are generally known to prospective new motor users as well as to experienced users of electric power.

Dominant advertising in the leading general magazines which has continued consistently year after year for a decade, had made the Robbins & Myers Motor favorably known to nearly everyone—the man who has not yet bought his first motor and the large motor user alike.

The service reliability and known quality of the R & M Motor combine to produce a profitable, growing motor business for the R & M dealer.

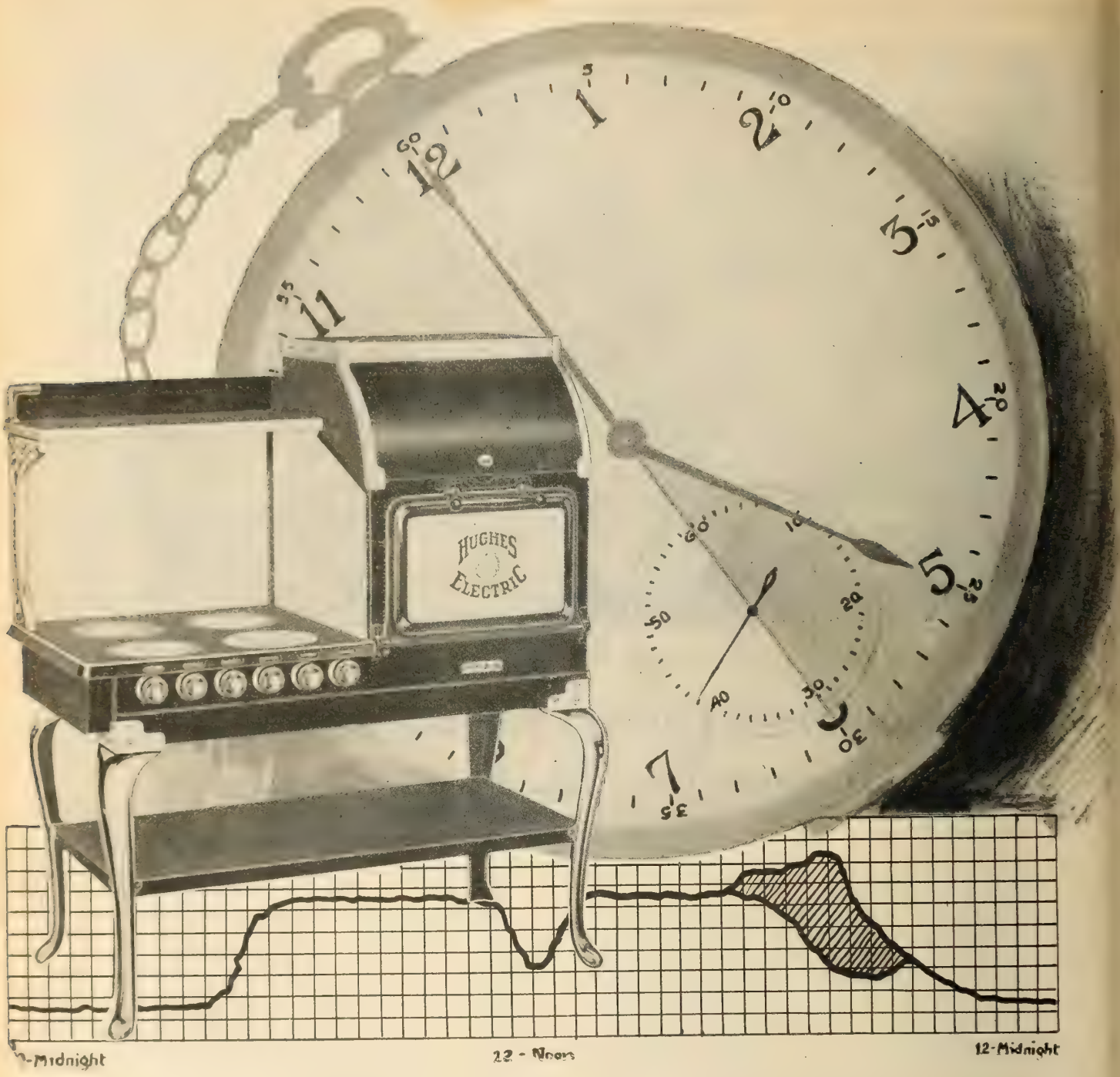
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"Daylight Saving" Has Claimed the Shaded Area

The load curve above is typical of the changed condition of the evening peak brought about by "Daylight Saving" Time. It probably approximates your own situation and you have no doubt already given serious consideration to its meaning in dollars and cents. But what are you **doing** to remedy this condition?

The proposition is simple. You have lost some load due to "Daylight Saving"—load that cannot be gotten back. The next best thing then is **other load**—preferably load that is as nearly profitable as that which has been lost. And a **Hughes Electric Range load comes as near to being the solution as anything that it is possible to secure!**

Never before has the Hughes Electric Range been so important **economically** as it is today. Never has it offered such tremendous possibilities to the nation as a conserver of food, fuel, transportation, time and labor. And never before has it held out greater advantages to central stations as a load builder of **certain** revenue earning power! Now all of this is amplified by a new National Time which has made a new "valley" in the station load curve—a gap that more than ever indicates the advantages of a Hughes Electric Range load.

HUGHES ELECTRIC HEATING CO.

364 Richmond W. **TORONTO, ONT.**

Electrical News
Generation, Transmission and Application of Electricity

Published Semi-Monthly By

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Subscribers are requested to promptly notify the publishers of failure or delay in delivery of paper.

Authorized by the Postmaster General for Canada, for transmission as second class matter.

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Vol. 27 Toronto, September 15, 1918 No. 18

The St. Lawrence Power Co. Demands

Comparatively little progress appears to have been made toward a decision in the matter of the application of the St. Lawrence Power Company for permission to construct a deflecting weir in the St. Lawrence River at the Long Sault. The Canadian Government takes the stand that it is a matter for consideration by the two countries involved and that it is without the jurisdication of the International Waterways Commission. On this basis it is argued that the proposed works would be in direct contravention of existing treaties. The feeling is general in Canada that the St. Lawrence Power Company, which is a subsidiary of the American Aluminum Company, is making the plea of war exigency to secure concessions which would not be considered under normal conditions. No doubt the suggestion that the consent of the Canadian Government would be forthcoming on condition that the work be removed within a year after the ending of the war is born of this thought. Considering that the cost of the weir is only estimated at $125,000, as compared with assets of this company probably running into around one thousand times this amount, the scrapping of the work would cause the company no financial inconvenience. The argument that the whole thing is just a "power grabbing" scheme seems to be further borne out by the fact that this company has large blocks of undeveloped power at different points in the United States; for example, on the Tennessee River, where it is estimated some 400,000 horsepower is running to waste.

Canada seems to have both law and justice on her side in demanding that when the St. Lawrence River is developed it shall be in such a way as to conserve the rights of both nations. The war necessity plea is the natural argument of an opportunist and must not pass without the most thorough investigation.

The T. E. L. Co. and its Steam Reserve

It is only on rare occasions that the daily papers essay to discuss technical matters and on those occasions there is generally an evident effort to advise themselves beforehand of the facts of the matter, but it is the exception that proves the rule and in a recent editorial the Toronto Telegram has gone out of the way to demonstrate that in matters about which it knows nothing it can draw most ridiculous conclusions from events and circumstances that, on the face of them, point in quite a different direction.

Some days ago the cars of the Toronto Street Railway Company were stalled for some time following trouble on their Niagara lines. Now everybody, including no doubt the Telegram, knows that such troubles, in the present state of the art of electrical transmission, are inevitable. The Hydro lines, as the Telegram well knows, frequently give trouble and greatly inconvenience not only the general public but, during the past year or two, the industries, both essential and non-essential over the whole province. The city of Toronto has, of course, experienced its fair share of this Hydro trouble and time and time again, as the Telegram doubtless knows, Toronto factories producing war essentials have been without the necessary power to operate their plants because of trouble at the Falls or on the lines between the Falls and Toronto. Everybody realizes that a steam reserve would have been the salvation of Toronto munition plants on numerous occasions.

In all these years the service of the Toronto Electric Light Company has been almost perfect. For example, a householder who uses their service for electric cooking in his home is authority for the statement that in the last four years his culinary arrangements have been interfered with on only one occasion—one isolated breakfast. In all these years the street railway service has never failed except for a duration of a few short moments. An unbiased review of these facts would seem to indicate that the steam reserve of the Toronto Electric Light Company, and their reserve storage battery plant, might be largely responsible for their excellent service.

But at last the Toronto Railway Company has failed to live up to previous standards. Why?

The answer, strangely enough, is given in full on another page of the same issue of the Telegram in which the editorial already referred to occurs, but evidently and unfortunately was overlooked by the editorial writer. It is pointed out, there, that some time ago Power Controller Drayton issued an order requiring the Toronto Electric Light Company to operate its steam plant for war industries and that, in consequence, this plant no longer constitutes a reserve power. It is further pointed out that through all the trouble on the line, which left the cars in part stranded, this plant was operating at full capacity, carrying essential industries. As a matter of fact the storage battery plant would have been utilized for the same good work had it been suited for this purpose but, in reality, it served the essential purpose of continuing the main arteries of the railway system in operation so that the inconvenience to the public was infinitely less than it would have been if this small part of the reserve had not been available.

So these are the arguments which, in the wisdom of the Telegram, absolutely condemn the use of a steam reserve. Essential industries carry on without interruption; street railway operated in part where, without reserve, everything

would be at a standstill. The Telegram appears to have small respect for the intelligence of its readers to expect them to follow such reasoning and, indeed, if we did not consider the management of this paper above such suspicion, we should be inclined to think that the editorial was written with some ulterior motive. However, there are the facts and we are satisfied to leave the whole matter to the good sense of the readers of the Telegram and to our own readers. There are valid arguments, in normal times, both for and against a steam reserve but no stronger reasons for its existence at the present time, and in the present case, could possibly have been put forward than those so prominently condemned in this illogical editorial.

Emergency Power Plants for War Work

T. W. Simms, chairman of the House committee on interstate and foreign commerce, has introduced in the U. S. House of Representatives, a bill to be known as the Emergency Power Act, which calls for the expenditure of $200,000,000 for the purchase and building of power plants. One clause of the bill empowers the President:

"To construct at any place or places within the boundaries of the United States such power plant or power plants as he may deem necessary, and in connection therewith to construct within such boundaries plants for the production of gas, coke, toluol, benzol, coal-tar products, and any other useful products that may be produced through or in connection with the coking of coal or lignite, or through or in connection with the combustion of any fuel."

It does not appear to be the idea of this bill to provide for the erection of hydro-electric plants, as this would take too long a time. However, a number of plants will be purchased or placed under the control of the government and enlarged or improved where this can be accomplished cheaply and quickly; also it is planned to erect a number of steam plants in coal bearing areas for immediate power production. By the expenditure of this money, the U. S. Government believe they will be in a position to produce the necessary war products in a minimum of time.

The Commercial Department in War Time

Mr. W. B. Johnson, manager of the new business department of the Montreal Light, Heat and Power Consolidated, read a paper on "The Commercial Department in War Time", at the convention of the Canadian Gas Association, held in Montreal. There were some points in the paper which are of interest to electrical as well as gas men. Mr. Johnson discussed the question as to whether companies should have discontinued commercial work after the outbreak of war. His company, said Mr. Johnson, had not found it necessary, nor advisable, to change the policy in this respect. It had been working for years on the principle that the new business department should be self-supporting and he was glad to note that so many companies were now seeing the wisdom of this policy and adopting it, although many formerly ridiculed the idea. He believed that every dollar earned by the commercial department should be spent for the promotion of the business and the obtaining of the goodwill of the public.

In the adoption and carrying out of such a policy there were many things that must be considered and which were governed by local conditions. The methods followed by one company might not prove successful in another city, so that local conditions should be studied before adopting new methods or systems.

Mr. Johnson then enumerated some of the problems of his own department. One was that the Montreal Light, Heat and Power Consolidated was a combination company and had the keenest competition to deal with, so that fully 75 per cent. of their energy was devoted to securing electric contracts for which the commercial department received no direct credit. Then the securing of desirable French-speaking salesmen was far harder proposition than one would suppose. The leasing laws, under which all moving was done in the first three days of May, handicapped the company in the matter of doing the regular work in the last half of April and the first half of May, the staff having to devote themselves to taking care of those moving.

The company was a firm believer in branch offices and showrooms. While these were opened for the "convenience of our customers" for the payment of bills and the application for service, they must show enough profit on appliances sold to be not only self-supporting but to leave a surplus to apply to other expenses of the new business department.

Since the opening of the company's new store on St. Catherine Street West, the company had added to its lines of neutral goods. The company, however, did not handle anything but allied lines such as pyrex glassware, aluminum cooking utensils, casseroles, percolators and teapots for gas ranges. Like most other companies they had lost considerable gas business to the electric due to the fact that it had not carried a suitable line of coffee percolators for gas ranges. There was no question that the electric percolator had been the means of converting a great many people to the use of electricity for various purposes.

The securing of goods and the steady increase in prices had been a great hindrance to the commercial departments but the companies' selling prices had been advanced to keep pace with the enhanced costs.

Safety Memoranda

The Ontario Safety League are distributing the following timely item:

We have noticed a large increase in accidents along Electric Railway tracks, especially on grades.

We have investigated a number of these accidents, and find that one of the most fruitful causes is the common practice among drivers of automobiles and other vehicles, of keeping on the tracks unnecessarily, or of driving alongside and stopping close to the tracks.

This practice is particularly dangerous, on account of the increasing width of the railway cars, and the increasing congestion of this branch of traffic.

Six feet at least, from the tracks, where possible, should be allowed to permit railway cars to pass with safety to vehicles and the passengers of both.

The League is asking the co-operation of railways and drivers of all vehicles, in this matter, and is posting notices asking drivers to keep off the tracks.

Any assistance you may be able to give us in the prevention of accidents of this nature will be very much appreciated.

Ontario Safety League.
J. F. Wyse,
Organizer & Engineer.

Illuminating Engineers to Discuss War-time Lighting Problems

The Illuminating Engineering Society will hold its annual convention at the Engineering Societies Building, 29 West 39th Street, New York City, October 10th 1918. War-time lighting economies, the use of better lighting in speeding up war production and manufactures, the lighting of camps, effect of lighting curtailment on crime, and automobile headlight legislation will be among the subjects to be discussed by lighting authorities of national reputation.

How the Electrical Services Were Affected in the Halifax Disaster

The Explosion and the Telephone

By Mr. W. H. Hayes*

The plant of the Maritime Telegraph & Telephone Company, Ltd., comparatively speaking, received little damage outside the area in the vicinity of the explosion, and otherwise was in full operation shortly after the explosion occurred.

All the buildings of the company were more or less damaged. The "Lorne" central office building most of all, it being in the north end of the city.

Local and Long Distance Lines Wrecked.

All the poles, cables, wires and telephones in the devastated area were of course almost wiped out of existence, and those that were not were so broken and tangled up with electric light and power wires, they were of no further use. The long-distance lines of the company passed right by the spot where the ill-fated boat exploded, and were on poles 35 to 40 feet in height, along with the wires of the Western Union Telegraph Company. A gap of one mile was blown in this line of poles.

The "St. Paul" central office building, located in the centre of the city, had the majority of its windows blown in, as also the head office building located near by, a number of the employees being more or less cut about the hands and face with flying glass. The "Harbor" central office building, located across the harbor in Dartmouth, had all its doors and windows blown in, but no one was hurt.

The company had just completed a fine new central office building on Sackville street, opposite the Citadel Hill, which they have since occupied as the "Sackville" central office, replacing the old "St. Paul" office. This new building had all the doors and windows blown, some out and others in. It had just been fitted up with the latest type of switchboard and would have been put into service two days later. While the explosion delayed the putting of it into service, it also forced the change to be made at the very first opportunity, owing to the congestion in the old office. The change was therefore made on the night of December 22nd, two weeks after the explosion. A staff of Northern Electric Company's men were at work in this building when the explosion occurred, finishing up the work of installing the new equipment, and some of them were very badly cut with the flying glass. A great deal of the glass in small particles got into the fine parts of the equipment, necessitating a great deal of tedious work to remove.

With the exception of two of the young lady operators, who were off duty at the time, and who were instantly killed at their homes, all the employees of the Company escaped serious injury and were soon at work again.

Switchboard Equipment Escapes Damage.

The fact that none of the equipment in the way of switchboards, etc., in the central offices sustained any damage, enabled the company to restore the service to most of the subscribers not in the devastated area, with very little delay. It is not likely there would have been any interruption whatever to the continuity of the service, except for the report circulated immediately after the explosion, that another explosion was imminent, and the order for every one to get out into the open. This caused every employee to flee for safety along with the rest of the population, leaving the switchboards to run themselves. This condition lasted for about one hour and a half, when word was sent around that all danger was passed. The operators and other employees then began returning to work in ones and twos until a full staff was on hand.

In the meantime the central office batteries had run down and required recharging. This could not be done until the power company turned on their current, which they were very loth to do owing to the possibility of starting fires through damaged wiring. However, after consulation with the City Electrician, Mr. Colpitt, it was decided to take the risk. Fortunately it caused no further damage and the switchboards were soon in full operation on the "St. Paul" office, but the "Lorne" office being in the area cut off by the explosion, it was two days before current could be turned on to charge the batteries in that office. Luckily the batteries had sufficient life to carry the load until the current was available.

In the "Harbor" office the battery charging current is supplied from Halifax by submarine cable across the harbour; this cable had been damaged and no current was available there. This was overcome temporarily by the installation of a complete gas engine and motor in one unit, which did the work until the current from the usual source could be supplied.

The first thing required was to get the openings in the different buildings closed up before night set in, and with quick and intelligent work on behalf of the staff was fairly well accomplished.

Telephone Connection with Dartmouth Severed.

The telephone connection between Halifax and Dartmouth is maintained by means of submarine cables carrying 100 wires. These cables were found to be working immediately after the explosion but not for long; they had been damaged but not enough to cut them off entirely. However the storms that came up right after completed the work, and the service was cut off between the two places. It was impossible to stop out on the harbour in order to take the cables up to make repairs, or to lay new cables, owing to the severity of the storm, which raged day after day. Consequently before the weather moderated a number of ships had been blown up and down the harbour, dragging their anchors to such an extent that they caught in the cables, and twisted and shifted them about so that they were completely ruined and unfit for further use. Fortunately a new 100 wire cable was already in stock and as soon as it was possible to do so this was laid across the harbour, but a week or ten days had elapsed during which time Halifax and Dartmouth were telephonically severed.

After getting the operating force at the switchboards and the opening in the buildings closed up temporarily, attention was next turned to getting the Long Distance Lines in working order. It was impossible to rebuild the blown away part of the pole line owing to the fires which were raging and the rescue work going on, even if the help and material had been available, which it was not. Some other means had to be found to bridge the gap and that without

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delay. This was done by connecting all the Long Distance lines where they pass through Rockingham, about three miles north of the centre of the City, on to the local suburban lines running in that direction, which enter the City via a different route to that of the Long Distance lines, and which were not damaged by the explosion. This temporary arrangement enabled the Company to place its main Long Distance lines into service the next day after the explosion, and to superimpose on one of them a telegraph circuit through to Boston for the Associated Press service, which carried the first full account of the disaster to the outside world.

A piece of iron from off the doomed boat, weighing about 25 lbs., came crashing through the roof of the "Lorne" central office building and landed about two feet from the operators, embedding itself in the floor. It just escaped the switchboards by about two inches. This building at first sight appeared to be a total wreck; all the windows gone and many of the doors; the back part of the building being broken away from the front part, and daylight could be seen through the walls in many places. Bits of boards, canvas, cotton and every conceivable thing that could be got were used to close up these openings. Even the window blinds were torn down, those that had not been blown down, and used for this purpose. When the blizzard came the next day the staff suffered considerably from lack of heat. It was impossible to keep the building warm with the regular heating apparatus owing to the drafts blowing through in every direction. Temporary stoves were obtained as quickly as possible, and more permanent repairs were made speedily. Only in this way was it possible to get along and keep the staff at work.

The number of telephones lost and destroyed were between 800 and 900, and all in the devastated area. The total direct cost of the damage to the Company will be about $65,000. The indirect cost, that is, the expenditures the Company will be compelled to make owing to changes being forced upon them on account of the explosion, will probably be over one hundred thousand dollars alone.

The outstanding feature of the work was the loyal self-sacrificing work of the operators at the switchboards and the repairmen who had to face the awful weather and keep it up day and night. The operators were at the switchboards continually, their meals were brought in to them, and at first it was necessary to supply them with sleeping accommodations. Owing to the severe weather conditions, and no street cars in operation it was necessary to convey the staff of about 80 operators to and from their homes or places of refuge. This work of course had to be performed by the men of the staff, with motors, sleighs or any form of conveyance possible to obtain that would answer the purpose.

The extra demand on the service was enormous; the Relief Committee, the temporary hospitals, railway and others all wanted additional and special service to assist them in their humane work of helping to relieve the suffering. Lines had to be built, telephones installed, and also a number of private switchboards were wanted to properly take care of the vast amount of calling. Hundreds of people did nothing else all day long but sit with the telephone calling and receiving calls, and when necessary to leave others took their place and thus kept it going. It was all supplied and the service rendered as well as it was humanly possible to do so.

Electrical Installation and Repairs

Halifax in pre-war days could never be called a well lighted city, although some attempts had been made to introduce modern lighting into the business districts, but with war regulations in force street lighting was greatly curtailed, and aside from a stray arc lamp and the light from show windows, streets were dark. The explosion of December 6th finished the street lighting, as practically every window in the city was destroyed, and consequently all store doors and windows were boarded up and the meagre light from these sources cut off. The explosion badly damaged the light and power lines of the Nova Scotia Tramway Company, and they were practically wiped out in the devastated area, although in those districts of the city where their poles were left standing, they made very quick recovery, and with emergency gangs accomplished wonders in a very short time in the matter of restoring these services.

Naturally all repair work was sadly handicapped by the necessity of workmen having to look after their missing relatives and friends, getting the injured to hospitals and providing some protection for their families and many of the Tramway Company's employees, including foreman and inspectors, were either killed or injured. The blizzard of Dec. 7th and succeeding days tied up all transportation and held up repair work on the lines, as well as causing additional serious damage; street car traffic was utterly demoralized for days and the task of getting the roadways clear and the lines in working order was herculean.

Darkness Hampers Relief and Repair Work.

The lack of light in the north end of the city was a great drawback to those engaged in rescue work, and the available supply of Daylos was quickly in use. Many of the automobiles engaged in the work carried a supply of candles for the use of householders who were without light of any description, and those trying in the darkness to effect temporary repairs to their homes.

After the urgent rescue work had been attended to, the first great rush, as far as the electrical houses were concerned, was the supplying of lamps and effecting necessary repairs to the equipment in the hospitals, shelters, bakeries, groceries and household furnishing stores; followed by the equipping of churches, basements, schools and any available place, as temporary homes for hundreds of families. With the rush of hospital, relief and repair parties to the city, it was necessary to equip any vacant buildings which were suitable, as camps, bunkhouses and dining rooms and the available electrical workers in the city were far from sufficient to look after this necessary work, and many were brought in from outside places, Montreal and Quebec supplying the major portion.

As soon as the relief work was thoroughly organized and put on a permanent working basis, the matter of erecting temporary homes for several hundred families was taken up energetically and, approximately, a thousand flats have been erected and furnished in a very comfortable manner for the use of those who lost their homes, until such time as the damaged houses have been made habitable, or new ones erected. The damage done to the interior of the houses throughout the city and which externally appeared to be in good condition has been enormous and the plaster in a large perecentage in the houses in the city has fallen, or has been damaged to such an extent as to make its removal necessary. This necessitates a very great deal of electrical repair work, especially in the older houses where the installations are far from modern, and the city inspector now insists that wherever it is necessary to remove the plaster, all electrical installations be made perfectly modern and up to a standard that will comply with the latest regulations of the Board of Fire Underwriters.

There are many hundreds of jobs of this nature to be done in the city, as well as the installations in the new modern and hydrostone houses being erected by the commission. A great deal of electrical work is being called for in connection with new buildings being erected by the Military and Naval authorities and by the Railway, in sheds, docks,

passenger station and car cleaning plant, and a very great deal of work in buildings being erected or enlarged for commercial purposes and in connection with the enlarging of the dry dock and the erecting and equipping of the plant of the Halifax Shipbuilding Company. There is not sufficient electrical labor to handle this work and great delays are being occasioned thereby. There are splendid opportunities at the present time for a large number of competent wiremen and linemen and splendid wages with abundant opportunity for working all the overtime they desire at inflated rates.

Fire Alarm and Lighting Service

The explosion resulted in serious damage to the fire alarm and the lighting systems of the city. The former was put completely out of commission. The storage battery, which supplied its energy was thrown from the racks to the floor by the concussion, and the circuits were all broken down, in many places in the city. In the devastated area signal boxes were all destroyed, some of them being carried over 100 yards from their original positions. The immediate difficulty was to establish a service of some character, and in order to do this it was necessary to have current. Fortunately Dalhousie College had a set of batteries of a type used for this purpose, and Mr. P. R. Colpitt, the city electrician, was able to borrow it. There being no means of direct communciation with places outside the city an order was placed, within an hour from the time of the explosion, with the Northern Electric Co. for new equipment. The company took energetic action, and immediately sent to the nearest point out of the city where it was possible to get in communication with outside wires in order to rush the order through. With the help of Dalhousie College and of some Northern Electric men who happened to be in the city, the city electrician was able to get a part of the system in working order the second day after the explosion. The greater part of the system however, had to be carefully gone over, as, due to concussion, many boxes were out of adjustment and would not respond quickly to the alarm.

The electric lighting service was completely demoralized but after patrolling the business section of the city, energy was turned into the lines in the afternoon of the day of the explosion. The light service in the devastated area was entirely destroyed, the poles, (which carry the lighting and street railway wires)—being broken, and the wires thrown down, including the portion of the high tension line serving the town of Dartmouth. Pending the new lay-out of this part of the city by the Relief Commission, nothing has been done towards reinstalling the lines. The plans of the Commission are to establish an underground service in the district referred to, with ornamental poles for street lighting. The city is negotiating with the Halifax Power Co. with a view to the street lighting being undertaken by that company, with energy from a water power on the North East River, 18 miles from Halifax. If these negotiations are completed the city will be equipped with about 1,000 lamps, consisting of luminous arcs and nitrogen incandescent lamps of different capacities, the large ones for the business section and the small ones for the residential districts. The present system consists of a series of enclosed arc lamps.

The outside wiring situation throughout the province has been put under the charge of the Provincial Public Utilities Commission, which is preparing a set of rules to be shortly issued to all companies. This will result in the line work being greatly improved and standardized throughout the province, where climatic and other conditions are exceptionally severe.

Hydro-electric Possibilities of the Halifax District

By Mr. G. E. Booker

It will probably be of interest to those who know little of Nova Scotia, to learn that within a radius of fifty miles of the city of Halifax there are no fewer than eleven rivers and streams capable of developing a total of some seventeen thousand horsepower.

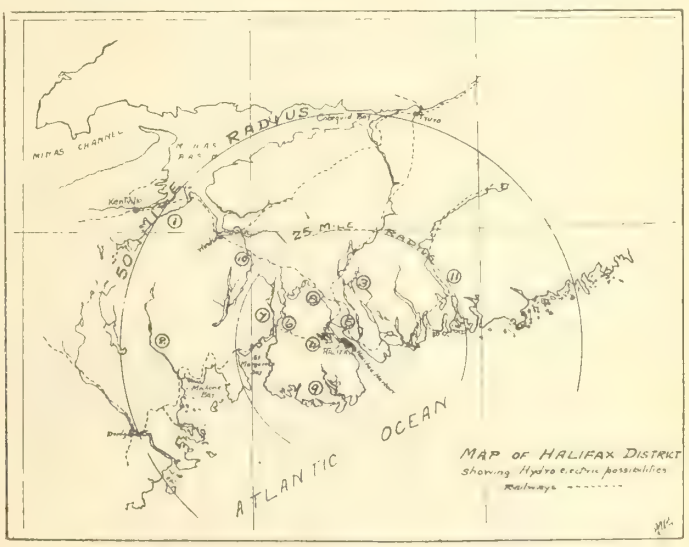
None of the developments are large, due to the comparatively small watersheds of the respective rivers; but owing to the rugged nature of the country, effective heads of from fifty to two hundred feet and over are obtainable. Up to the present time, however, practically no use has been made of this water power, in fact only one stream is developed to anything like capacity, and that is only equal to about three hundred horse-power. Although there have been a number of schemes drawn up within the last few years, nothing has up to the present materialized.

The Halifax Power Co., Ltd., has the construction of its first unit on the North-east River under consideration, and hopes to have same completed at an early date.

The demand for cheap electrical power is one of vital importance to this locality, not only in the encouragement of new industries, but as a means of fuel conservation. The attached list of rivers and streams in the locality, together with the power capacity of each, is compiled from the Progress Reports of the N. S. Water Power Commission, the activities of which body are under the efficient direction of Mr. K. H. Smith, resident engineer for the Dominion Water Power Branch.

Hydro-Electric Power.

Several of the smaller municipalities in the Province are also contemplating the development of Hydro-electric power



Hydro possibilities in vicinity of Halifax

for lighting and power purposes, as the advanced cost of fuel has greatly increased the cost of operating the existing small steam plants. Unquestionably every stream which can be utilized for power purposes economically should be developed now; as it is only by thus making preparations for increased industrial activity after the close of hostilities that can we hope to be in a position to compete with our manufacturers in the world's markets. In this connection it may be pointed out that Great Britain had up to the outbreak of the war only three small Hydro-electric developments, aggregating only some three hundred and fifty horse-power. Since that time,

However developments capable of an output of about eleven thousand horse-power have been constructed by private parties, and further additions aggregating some seventy thousand horse-power are under consideration, as a means of obtaining cheap power for manufacturing purposes and of conserving fuel.

A bill dealing with the water-powers of Nova Scotia was passed during the last session of the Legislature which should in some degree assist in the economic development of these water-powers; and although it is doubtful whether an immediate market could be found for the total power available it can safely be stated that, with the promised industrial expansion of the locality, the demand for electrical energy will very rapidly outgrow the supply.

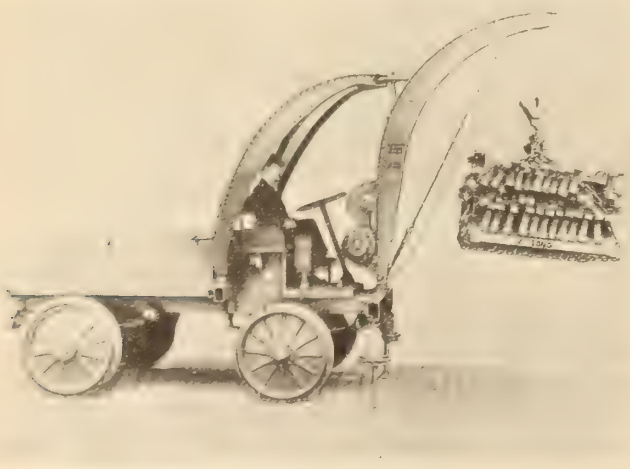
List of Power Possibilities of the Halifax District.

Ref. No.	Name of river.	Approx. distance from Halifax.	H. P. available at turbine shaft.
1.	Gaspereaux	50 miles	7,437.
2	Gold	45 miles	3,084.
3	Fall	11 miles	564.
4.	Kerney Lakes	7 miles	313.
5.	Dartmouth Lakes	3 miles	158.
6.	Northeast	16 miles	4,209.
7	Indian	16 miles	4,209.
8.	Pernant	12 miles	264.
9	Sackville	16 miles	947.
10.	St. Croix	30 miles	no data.
11	Masquodoboit	25 miles	no data.

Electric Vehicle Crane Tractor

By A. Jackson Marshall

A Chicago manufacturer of electric vehicles recently placed on the market, in response to a demand from terminals and manufacturing plants, a tractor equipped with a two-ton capacity crane, also operated by electric motors, and supplied with current from the same storage battery used to propel the electric vehicle. The demand for this mobile electric tractor crane was created principally through war conditions and the consequent handling by such plants of many heavy materials in large units. Although it has not as high a lifting capacity as many locomotive and overhead cranes, it has, however, the advantage of being more flexible in its radius of action.



Vehicle and crane operated by storage batteries

Recently one of these tractors was observed unloading a freight car at a well known terminal. It was handling large crates of army kitchen equipment weighing approximately 3700 pounds. After lifting the cases off the freight car, it backed away, and running across the pier under its own power, depositing its load. While this is a somewhat larger load than the tractor was figured to carry while in motion—the manufacturers would prefer loads to be limited to 2000 or 3000 pounds in such instances—the ordinary stationary crane having only a maximum capacity of 4000 pounds—the electric crane tractor performed its duty easily. The boom of the tractor swings 180 degrees so that after material is lifted it can be deposited easily on the ground or on a trailer for transportation elsewhere.

This electric tractor is also equipped with a spring drawbar coupler at the rear of the frame. It is possible therefore to load trailers by means of the electric crane and then haul these trailers electrically to another point and unload them. As a tractor it can haul a gross trailing load of fifteen tons. Electric tractors of this type have been used in many instances to "spot" loaded freight cars, either pulling or pushing them.

This tractor is another member of the electric vehicle family which embraces light and heavy duty commercial (street) trucks, passenger cars, electric wheel chairs, canoes, electric industrial trucks and tractors, including those equipped with cranes and self-elevating platforms, which are contributing no small part in our successful war operations, as they not only expedite the rapid and economic movement of materials and munitions, but, by virture of their gluttony for work, are releasing thousands of men otherwise needed. In fact many of these vitally necessary small but powerful electric vehicle transportation units are being operated successfully by women.

A New Commercial Application of Electrolysis

According to La Energia Electrica a new small industry has just been started in Valencia, Spain. In this district a large number of small decorative articles are manufactured in clay, glass, wood, and papiermache. Some of these are now being encased in a thin "skin" of metal, which greatly improves the appearance and permanence of the articles.

The method employed is simple. A small compressor supplies air at a pressure of about seven atmospheres to a receptable filled with metallic powder (generally lead, for cheapness). At the moment the metallic powder emerges from the jet, it is melted by an oxy-hydrogen flame, and a spray of molten metal encases the object to be "metallized", which is placed on a revolving platform. The object then goes to the electrolytic bath, and receives its new skin of copper, silver, or gold. Glass articles are first treated by a sand-blast to ensure the necessary toughness for the adhesion of the lead. A new type of Leyden jar is also being manufactured, in which the old silver-foil is replaced by a homogeneous film of silver.

Clothes That Hamper Action

If you hired a man to work for you and gave him a suit of clothes, it would be to your interest to see that his suit was not too tight, restricting his legs and arms and preventing him from doing proper work. Maybe at the end of a year you'd enlarge his clothes to give his bigger muscles more room. At any rate, it would be the last thing you'd do to hamper and hinder his actions.

It's the same with a franchise. It may hamper and hinder the street railway in giving you the best service. If it is cut according to the 1901 fashion, it will not do for 1918. The 1918 fashion may not do for 1930.

What is needed is a garment that will allow for the natural expansion of the street railway as it is found necessary to meet the growing needs of the public.—B. C. Buzzer.

Labor Problem and the Electric Railways

Of Three Factors in Railway Operation, Employees, Public and Investor, Employees Come First—Their Co-Operation Must Be Secured and the Public Be Convinced That Good Service Demands Fair Pay

Street railway companies are being harassed in their operations all over the American continent by the increased cost of everything entering into the operation of their systems, chief of which perhaps is the cost of labor. Nor can the employee be blamed for the necessity that drives him to make ever-increasing demands. It is merely incidental that the labor shortage makes him independent—with the greatest imaginable surplus of labor supply, justice would require a much increased wage over that of four or five years ago. In view of these facts it seems to indicate a strange perversity of human nature that the public, in general, so insistently objects to any increase in railway fares. It is strange that the British ideals of fair play for which we are fighting to-day would not rather incline them to grant, without argument, the increase that has been arbitrarily demanded in almost every line of merchandising to-day—often without justice or real necessity.

Probably the reason lies in a lack of understanding, by the general public, of the railway situation. With the butcher, grocer, haberdasher et al, the public pays the added cost, for the most part willingly, because they have had the situation explained to them. Of course they had no choice anyway and perhaps this has helped to an understanding. But in any case it seems essential that the electric railway situation should be explained.

An interesting article by Mr. Britton I. Budd, president of the Chicago elevated lines, discussing the possibilities of a better mutual understanding between the companies, their employees and the public, appears in a recent issue of the Electric Railway Journal. Electric railways, he says, are to-day facing the most serious problems in their history. Conditions brought about by the steadily increasing costs of operation, due to the enormously advanced prices of materials and labor, with revenues limited by national, state and municipal regulating authorities, call for clear thinking and sane acting, if receiverships and industrial chaos are to be averted. Owners of electric railways must look forward, not backward. The problems confronting them must be met and solved in the light of present day knowledge and understanding, rather than by the experience of the past. Especially does this appear in dealing with labor problems, for methods which might have been applicable even ten years ago are to-day obsolete and out of place.

The Employees, the Public and the Owners

In the operation of electric railways there are three factors to be considered, namely, the employees, the public and the owners of the properties. Each factor is entitled to a fair return on his contribution toward the success of the enterprise, and each must be given consideration in determining what that return shall be. If one of the factors in this equation demands and receives more than its fair share, it must be at the expense of the other two factors, and this presents a condition which calls for an adjustment.

In my classification of the factors I have given the employees first place, because in many ways I feel they are the most important. If employees are reasonably well paid, if they are given the best working conditions which the character of the work will permit, they will be contented and will work and co-operate with the company. Such co-operation makes possible the best service to the public, which means a better return on its investment. If the employees and the public both are satisfied, the owners of the property are more apt to be satisfied, because operation under such conditions will be successful, assuming, of course, that revenues are sufficient to make a reasonable return to all factors.

Let us briefly consider what are the rights of each of the factors in this equation and their relations each to the other.

The National War Labor Board, in laying down certain general principles and policies to govern relations between workers and employers, has said: (1) "The right of all workers, including laborers, to a living wage, is hereby declared." (2) "In fixing wages, minimum rates of pay shall be established which will insure the subsistence of the worker and his family in health and reasonable comfort."

It will be observed that in laying down these general principles, the War Labor Board has not considered the financial condition of the employer. The inference is plain that workers are entitled to a living wage, and that the ability of the employer to pay that wage is not the main issue.

The owners of electric railways should face the situation squarely. Demands of employees for increased wages cannot be dismissed on the plea that the company is financially unable to meet them, even though that plea is literally true. Such a plea will satisfy neither the employees nor the public and it behooves the owners of electric railways to face about and seek ways and means of increasing revenues.

Railways are Not a Philanthropy.

At the present time wage demands have been made on many electric railways which if granted would mean utter financial ruin, unless ways are found for increasing revenues. If the electric railways wish to be regarded as eleemosynary institutions and sell transportation at less than cost, the employees cannot be expected to engage in such philanthropic enterprises. The public should not receive goods at less than cost, at the expense of those engaged in producing such goods, and this applies to the investment made by both capital and labor.

The term "living wage," which the War Labor Board has declared each laborer entitled to, is rather a loose term and ambiguous. It would, however, be impossible for any board to define in exact terms what constitutes a living wage. We find one man supporting a family in comfort on a wage which another man similarly situated finds altogether inadequate. A great deal depends also on locality. What might be a fairly adequate wage in one part of the country may not be adequate in some other section.

Labor Must Be Held in a Competitive Market.

The owners of electric railways, however, need not greatly concern themselves on that point. They must be prepared to pay wages relatively as high, all things being considered, as are paid in other industries, or they will not be able to procure the labor necessary to operate their lines. Many already are experiencing difficulty in this direction and the public suffers as a result of the quality of the service. However much we may differ in opinion as to what con-

[illegible] a fair rate of pay for employees of electric railways, [illegible] affect, I believe, that wages that were fair in pre-war times are not fair to-day, because the purchasing power of the dollar has materially decreased. We must recognize that fact and deal with our employees accordingly.

What are the rights of the public in the matter? What attitude should the public assume toward electric railways? The public is entitled to the best service that can be given for the price paid. In this respect the public often is short-sighted as it does not fully appreciate the relation of the service to the fare. It is impossible for any public utility company to give the best service unless it is earning a fair return on its investment. In other words, the character of the service must depend upon the price paid for that service.

Generally speaking, the attitude of the public toward electric railways and other utilities is not a fair one. While demanding more and more in the way of service, the public is unwilling to pay for what it asks and expects. Any suggestion of increasing rates for transportation usually meets with public opposition, regardless of the financial condition of the company. Prices of all other necessities advance, but to-day the price of transportation on many electric lines is actually less than it was ten years ago, although the service given has steadily improved

Where Do the Owners Come In?

The owners of electric railways are entitled to as square a deal as the other two factors in the equation. They are performing a great public service, for which many times they receive neither credit nor adequate return on their investment. Sometimes, perhaps, they are themselves to blame. Too often in the past the electric railways have taken a position of standing between the public and increased fares. They have met the demands of their employees for increased wages with the assertion that the rate of fare will not warrant any advance in wages, and they have appealed to the public to support them in that position.

This policy has never earned the good will and support of the public, while it has incurred the ill-will of the employees. The owners must adopt a policy of perfect frankness with their partners in the industry. They must first have a good case to present, as most of them have, and then they should see that it is intellingently and frankly presented. They have no right to expect their employees to accept lower wages simply because they are selling their product to the public at too low a price. Instead of flatly opposing reasonable wage demands on the part of their employees, they should bend their energies toward producing higher revenues and, by dealing frankly and openly with their employees and the public, they will have the co-operation of the former and lessen the opposition of the later.

Rate Advances are Generally Slow.

We all realize that it is an extermely difficult and slow propostion for a public utility company to advance rates. The manufacturer engaged in private enterprise meets increased wages or higher costs of materials by advancing the price of his product to the consumer. The burden is easily shifted. Not so with the electric railway company. It must be able to show the various commissions and boards, charged with the regulation of rates, that the increase asked for is justifiable. It is a matter of common knowledge that in some states, boards and commissions in making awards frequently are governed by popular sentiment rather than by the actual merits of the case. This makes it all the more necessary for public utilities to be frank and open in their relations with their employees.

Never was there a time as opportune for educational work on the part of electric railways as the present. They are absolutely essential to the successful prosecution of the war. The hundreds of thousands of employees engaged in war industries must be provided with means of transportation to and from their work. The public has grown accustomed to higher costs of every necessity, and the necessity for increasing wages is generally recognized, even if the scarcity of labor did not make such increases imperative in order to hold men in the industry.

Electric Railways Are an Essential Industry.

The importance of the electric railways in these war times is not yet fully appreciated by the public, but there is no one factor probably that is of more importance to the successful prosecution of the war than the electric railways, inasmuch as they serve practically every form of industry engaged in the manufacture of war munitions, ships, etc. In fact they are indispensable and it is most essential that their revenues be sufficient not only to enable them to maintain the best of service, but also to put in improvements and extensions to plants, shipyards, cantonments, naval stations and other war activities.

The banks, trust companies and insurance companies throughout the nation are large holders of the securities of electric railways, and conditions which would bring about depreciation of these securities would have a serious effect upon the entire financial structure of the country. Government officials realize the importance of the electric lines and have shown a disposition to deal with them fairly. This fact should be emphasized in every possible way, until the truth is forced upon the public mind. When the public is fully enlightened on the seriousness of the situation, the way will be paved for a comprehensive plan which may require national legislation to insure sufficient revenues to do justice to those who have invested their capital in electric railways and to enable the companies to perform the service which is expected of them.

In this campaign of enlightenment the employees of the companies, if fairly treated, will be found ready to co-operate. It is inexcusable to overlook the fact that the employees of the industry are a powerful influence in making public opinion. The question for the industry to determine in these critical times is how much of an effort it is willing to make to break down antagonisms that have existed too long and, in lieu thereof, to enlist the employees' help in working out the complex situation in which the companies find themselves.

The Annual Financial Review

The Annual Financial Review covering the year ended June, 1918, is just to hand. This is a carefully revised summary of facts regarding securities listed on the Montreal and Toronto stock exchanges and of other prominent Canadian corporations. It includes the current annual statements of companies, the highest and lowest prices of stocks and bonds on both exchanges for each month for ten years, the number of shares sold each month for the past fifteen months, rate of dividends paid for past years and other important items in the history of the different companies, such as increases in capital stock, particulars of franchises, when bonds are redeemable, dividends payable, etc.—information of value to any investor who wishes to make an exhaustive study of any particular stock before placing his order. The review comprises 740 pages of solid information, well printed in a clear and concise manner, and is neatly bound in full cloth. The work is most valuable not only to financial institutions, but even more to the general investing public, whose knowledge of such matters is necessarily limited. Published by Houston's Standard Publications, 84 Bay St., Toronto; price, $6.00 per annum, including any supplements that may be issued.

One Year's Experience with Automatic Rate System

By Harold W. Clapp*

The franchise of the Columbus Railway, Power & Light Company suburban line to Westerville, 13 miles from Columbus, is based upon the premises, first, that a community should say what it wants in the way of service, and second that it should pay for such service. The past year's experience is described in Electric Railway Journal by Harold W. Clapp, general superintendent of the company. Briefly, the company is allowed under this franchise to earn 6 per cent. upon the value of the investment fixed by arbitration, and 8 per cent. upon new capital. The County Commissioners, acting through a street railway commissioner, have the right to prescribe conditions of service, and the company is in duty bound to provide the prescribed service.

Flexible Fare Automatically Adjusted

A sliding scale of rates of fare is provided, automatically adjusted with the fluctuations in the working capital, as was provided in the Tayler ordinance in Cleveland. In fact, the Westerville franchise is in general based upon the Tayler ordinance, which provides a most logical and workable mechanism for insuring a fair return upon the investment in electric railway properties with the exception that it imposes a fixed maximum fare. The recent law enacted by the Massachusetts Legislature, by the way, eliminates this weakness by always insuring four steps in the fare scale above or below the step established at any time.

In the case of Westerville, the sliding scale of fares is as follows:

(a) Four tickets for 10 cents, or 2½ cents fare.
(b) Five tickets for 15 cents, or 3 cents fare.
(c) Ten tickets for 35 cents, or 3½ cents fare.
(d) Five tickets for 20 cents, or 4 cents fare.
(e) Ten tickets for 45 cents, or 4½ cents fare.
(f) Five tickets for 25 cents, or 5 cents fare.
(g) Ten tickets for 55 cents, or 5½ cents fare
(h) Five tickets for 30 cents, or 6 cents fare.

The cash fare is 5 cents a zone except under (f), (g) and (h), when it is 6 cents a zone.

Operation under the franchise began on Aug. 1, 1917, under schedule (d) with a ticket fare of 4 cents or five tickets for 20 cents. Soon afterward a commutation book was provided for six and seven-day regular riders, giving them two rides each week day or every day, as the case might be, at 3¼ cents a zone. The only limitation on the use of this book was set by the dated tickets, each coupon bearing the date upon which it might be used.

The public control of the service on the Westerville line lies in a street railway commissioner, appointed by the body that originally granted the franchise, the County Commissioners. His salary is paid by the car riders of the Westerville line, as it is charged against them in the operating costs.

The control of the service includes the right on the part of the street railway commissioner, acting for the public, to fix and alter car schedules, increase or diminish the service, propose extensions, betterments and permanent improvements, and approve or disapprove the same when proposed by the company. In short, he represents the car riders in all things affecting service and the cost thereof.

Operations under the Westerville franchise have been carried for more than a year. At the end of the eleventh month, which was June 30, 1918, the working capital had shrunk from $25,000 to $15,087.69. This would indicate that the rate of fare maintained was too low. It is altogether likely that by September 1, at the very latest, with all accrued accounts adjusted, the working capital will have shrunk below the $15,000 mark. At that time or thereafter as that fact can be officially determined from the reports of operation, the fare will automatically increase to the next higher rate, which in this case is 4½ cents per zone. Commutation rates will follow the upward trend and instead of being at the rate of 3¼ cents per zone the tickets will be sold at the rate of 3¾ cents per zone.

Local Street Commissioner Is Doing His Part

During the past year John Scott, the street railway commissioner, has been constantly "on the job" of watching the service and making inquiries and suggestions. It must be remembered that this road is a small operation, as electric railways go, and that Mr. Scott as commissioner took hold of it at a time when it had been a going concern for twenty-five years. The possibilities for suggested changes are not so numerous as they would be on a more extensive transportation system. Nevertheless, Mr. Scott has found opportunity to serve the public most efficiently. He has taken particular pains on many occasions to go to Westerville, which is 13 miles from Columbus, and hold meetings and conferences with the city commission and with the Chamber of Commerce and with them go over the reports rendered him monthly by the company. These reports, by the way, show the financial results for the previous month; they are made in great detail to the commissioner by the 15th of the following month and follow the official classification as to form. A condensed statement from this report is printed on a bulletin and hung in a neat frame in the Westerville cars each month and also sent to the Columbus newspapers and to Public Opinion, the Westerville local newspaper. Publicity is the real watchword of such a plan of operation.

In the early part of the year the commissioner made special efforts to see how the newly-arranged zone worked out so far as accommodation of car riders was concerned. He called for only one change during the year and that was in the case of a church located 600 feet from the end of one zone, and he ordered the cars to change this zone limit on Sundays for the church goers only. The use of the line as a freight line by the merchants of Westerville would be greatly increased if a better located terminal for receiving freight could be had at the Columbus end. The company had been for a long time trying to find such a terminal but in vain. Mr. Scott has been striving to the same end. In many other minor ways Mr. Scott has made suggestions and inquiries. He is just at this time commencing the most important move for his car riders, in attempting to get the taxes assessed against the Westerville line reduced to a more equitable basis. The Westerville car riders are paying about $9,000 a year taxes when in all fairness they ought to be paying about $3,000. Mr. Scott has the county commissioners and the county attorney behind him in the fight that he is planning on this point.

Railway managers might as well face the fact that the time is here when the public ought to, and is going to, dictate electric railway service. The public is going to insist, in fact is insisting, upon saying when, how and where cars shall be run. I say, let the public do so if it pays for the service.

There would be no trouble about this phase of it except for franchise restrictions on rates of fare. There's the rub! No progress is possible until the old contracts are voluntarily abrogated or rendered null and void by the rulings of commissions, when such bodies have rights superior to those

*General Supt., Columbus Railway, Power & Light Co., Columbus, Ohio

[illegible] matter. Where mine palaces alone [illegible]

Zone System Only Just Plan for Large Cities

[illegible] necessary on a line like the Wester- [illegible] it is advisable in city operation must [illegible] local centers. The shape of a city and [illegible] all business centers have more to do with this question than mere population. Real estate developments, usually allowed to locate without regard to anything except the profits of their promoters, often produce abnormal situations where the installation of the zone system is necessary. I have observed that when an American city gets above, say, 500,000 in population, the zone system is the only just one for both public and the company. It is likely, in my judgment, to make headway in this country in the years immediately after the war, when it may be found that a much higher price level will exist than is popularly predicted now. The zone system will make it possible to place upon the shoulders of those getting the benefits the cost of operating lines that would be unprofitable as part of a flat-rate system.

But whether a flat rate or a zone is used, the fare ought to be flexible or follow a sliding scale. The time has gone by when cities or companies are going to get each other by the throat with a fixed fare. Any community is interested in service first—what it shall be and how it shall be rendered. The public is also learning that it is interested, for selfish reasons, in the ability of its electric railway to provide that service, and to grow not only with the town itself but also with changing methods of conducting transportation. It begins to be apparent to both sides that the price of service cannot be, safely for either side, fixed for a term of years.

The provision for a sliding scale in Westerville takes care of fluctuating costs, downward as well as upward. It is done in this way: A total of $25,000 of the capital of the line was in cash and was termed the "working capital fund." All the surplus at the end of each month, after paying operating costs, maintenance, taxes and interest at 6 per cent. on the capital invested ($300,000 in this case) is paid into this fund. When the working capital fund increases to $35,000, the next lower rate on the schedule may be ordered into effect by the street railway commissioner; when it shrinks to $15,000, the next higher fare may be installed by the company.

Get an Automatic System Now

The whole matter of fares is complicated at present by the fact that many of the electric railways do not appear to know what they want in the way of a permanent settlement. One company asks for an increase of 1 cent, and another for 2 cents. A third wants a charge for transfers, and a fourth prefers the zone system. It is understood in all cases of appeal for emergency relief that any relief given now will be temporary if operating conditions continue to become more and more strenuous. Obviously the wage increases are constantly demanded, as material prices mount skyward, as interest rates go up, there must come a time when another increase of fare will be asked for. On the other hand, it is conceivable that prices might go down, leaving the rate of fare too high. Then the public must go through a process the reverse of that instituted by the companies when they appealed for higher fares.

In other words, under the present general plan there will be a seesawing up and down, with somebody always appealing for something. Why not take the bull by the horns and throw him—that is, make now the effort necessary to institute an automatic system, fair to everybody, and dispense with all this appealing, which is a constant source of irritation?

If this plan is followed it may, in many cases, be necessary for holders of stock to consent to a considerable reduction in its volume. It is better, however, to have less stock of a marketable and dividend-earning character than the greatly depreciated, sluggish stock which characterize so many properties and which a man would be called a fool for buying. In Cleveland, where the stock total was cut, the stock is now owned by many times as many stockholders as formerly, and it is a gilt-edged investment.

The only way out, in my opinion, is a service-at-cost system. This plan removes the veil of mystery from the finance and the operation of a public utility. The community immediately realizes that the utility stock is a safe investment because the community has in effect guaranteed the security. Being aroused to an interest in its public utility, the community thereafter invests its savings in it, and the final step is a long move toward co-operative ownership and a boosting instead of a knocking community.

Is this not what the management of public utilities should be trying to secure?

Personal

Mr. W. H. Morton, formerly secretary of the National Association of Electrical Contractors and Dealers, has been appointed general manager of the organization.

Mr. Fred J. Pratt, for sixteen years storekeeper for the W. E. R. Company has been appointed purchasing agent to succeed Mr. Mackenzie. Mr. D. Roche, for twelve years chief clerk to Mr. Pratt, has been made storekeeper.

Mr. Lawrence Palk, assistant to the General Manager of the Winnipeg Electric Railway Company has also been appointed assistant secretary of the company as well as secretary of the Winnipeg, Selkirk and Lake Winnipeg Railway Company. Mr. Palk has been with the company for 14 years in a secretarial capacity.

Mr. G. A. Henson, who for the past three years has been assistant treasurer of the Winnipeg Electric Railway Co., has resigned after eighteen years service. Mr. Henson's initiation into street railway transportation dates back to 1890 when for five years he constituted the whole office force of the old horse car company. When the horse cars went out of business in 1895 he entered the fire insurance business but rejoined the Winnipeg Electric Railway in 1900 in the accounting department.

Mr. J. S. Mackenzie, former purchasing agent of the Winnipeg Electric Railway Co., has been appointed treasurer to succeed Mr. Henson. Mr. Mackenzie has had sixteen years service with the firm. He was formerly with the Toronto Railway Company but went to Winnipeg in 1902 when he joined the staff of the Winnipeg General Power Co. When that firm was absorbed in 1906 by the Winnipeg Railway he went with the latter company as purchasing agent, a post he has occupied since that time.

Opening Meeting of The Electric Club of Toronto

The opening meeting of The Electric Club of Toronto will be held on September 20. Arrangements have been made whereby the Club will meet in the Prince George, as formerly. The first Friday's proceedings will be of unusual interest, for Mr. Kenneth J. Dunstan, president of the Club, has consented to address the members on certain phases of his trip to England and France during the present summer. Mr. Dunstan's mission to the Old Land was primarily in connection with Red Cross work, but he saw many other things and members may look for a rare treat.

An Evening's Experience in France

Our readers will be glad to hear of the safety of Mr. M. B. Hastings, secretary, A. H. Winter-Joyner, Ltd., who, it will be remembered left Canada with the 4th Canadian Mounted Rifles Battalion, B.E.F. He since has been transferred to an artillery company and in a recent letter to Mr. Joyner describes a typical evening's experience. The following extracts are of keen interest—from a letter dated July 31:

"You gave me your trials and temptations so I'll give you a brief review of one of my evenings about three nights ago. That day I was playing h—— with the Hun's outposts, knocking them in and causing his angry passions to rise. Sud-



Lieut. Hastings is second from the left in upper row

denly, Crash! Bang! and he tried to knock my gun out. He threw everything but 8 inch shells and up. After about twenty minutes he stopped, so just for fun I gave him five for luck and had the crew beat it for safety. It was funny the antics the Hun went through trying to locate my gun. It was still there when I left to come out for a few days' rest.

"I got to our headquarters behind the line a short distance where we lived in a tin hut, very well concealed by a hedge. It was purely a condition of concealment vs. protection. It worked fine until the Hun apparently noticed too much movement and decided to investigate. He had been shelling very close to us, (within a hundred yards,) for over a week and we hoped he would stay there.

"When I got back I was told the Hun seemed to be searching and was putting shrapnel very close. We were used to that, having had our roof punctured on different occasions. On my birthday I picked up the ragged piece of a shell without getting out of bed.

"Well, I ate dinner while the other two played cards. After dinner I read the paper. Swish bang! Three times. I think I'll get out and see what it's all about, says I. The next one burst right above us and the nose-cap (about a two pound piece), went through the chair I was sitting on and through the floor six feet into the ground. Everybody moved because he was putting them over in salvos. I ran for a dug-out and just got there when my sergeant got hit and knocked out. I ran back and pulled him in. I don't know how I escaped as two others were hit, but not serious. Just as I got the sergeant to the mouth of the dug-out a shell burst right at the mouth and the concussion blew us down the hole together. The blaze almost blinded us also. We were safe then, so I proceeded to dress the sergeant's wound.

"After the strafe was over we got an ambulance and got the sergeant to the A. D. S. where he was off to the rear in less than half an hour.

"As we were there a man came running in to tell us a shell had burst amongst a group of men and horses. The three officers of our battery, (including myself), decided to get busy. We got to the place and found a horrible mess of men and horses. The three of us got six men to the A.D. S. and got their wounds dressed. We then came home and decided to sleep out in a hole. When I went to my sleeping bag I found seven bullets in it.

"We slept like tops, the O. C. and I in the same hole. The next morning I looked at my trench coat and it was all stained with blood from the poor chaps. We then looked over our former home and I counted seventy-two holes in the roof. I dug out the nose-cap and kept the bullets which were in my bed and they are now on the way to———.

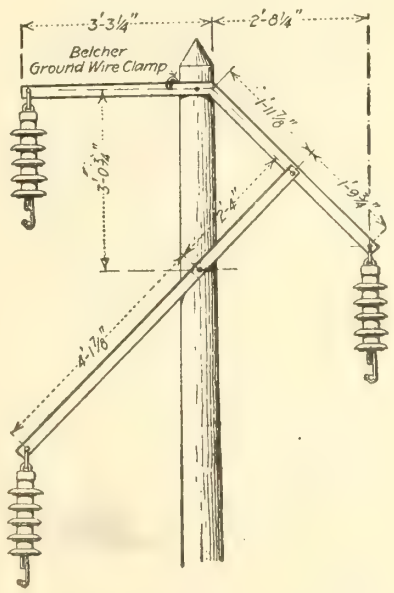
"We moved our headquarters."

Under date August 9, when the Allied offensive was well under way, Mr. Hastings again writes: "This is probably the first letter you have received which was actually written on a battlefield while the action was in progress. I can't tell you more at present. The boys have again covered themselves with glory and we are a proud lot. It takes more than Huns to stop the boys with such jump in them and such a high morale."

And on August 12, "Fighting is very hard—we have advanced 20 km. I am well but very tired."

Steel Cross-Arm of Easy Construction

A simplified modification of the wishbone cross-arm worked out by the engineering staff of H. M. Byllesby & Company for use on Southwestern properties is described in a recent issue of the Electrical World. Its construction is very simple. It consists of two pieces of 2.5-in. by 2.5-in. by 5-16-in. angle iron held together by a single bolt. The upper



piece contains only one bend and the lower member is straight. The pieces, which together weigh 65 lb., are held together by a ⅝-in. bolt 1.5 in. long. The arm is bored for two ⅝-in. through bolts, for three 0.75-in. insulator "C-hooks" and for a 9-16-in. Belcher ground wire clamp. The arm shown is made for 66,000 volts. It has been used by the Oklahoma Gas & Electric Company, and in this lightly loaded district it has given general satisfaction. It is light in weight, is easy to manufacture and assemble, on account of having so few bends, and affords ample clearances.

The Dealer and Contractor

Arguments to Combat the Average Customer's Objections to Wiring His Home, Installing More Outlets, Buying More Appliances —Sell Convenience, Economy, Utility

In support of the Convenience Outlet Campaign, being carried on during the month of September, the Society for Electrical Development have prepared a number of business-getting arguments and methods designed to meet the objections of the average householder. These arguments would be equally effective, however, in any contractor-dealer's campaign and we print them herewith believing they will assist materially in any drive for more business.

Every prospect you approach will advance some objections to offset your solicitation of wiring business and orders for appliances. Many, if not all, of those objections can be anticipated. And in every instance plans for dissolving such objections may be formulated in advance and held ready for use when needed.

Some of those plans may be found by test to require modification or additions to make them properly effective. But even so, a plan, regardless of its weaknesses, is infinitely better than no plan at all. So accept these plans to start with. Improve upon them as you go along.

Remember: While you sell wire, outlets, experience, labor and appliances, your customer buys economy, utility, convenience and satisfaction of this, that or the other particular need. Keep that thought in mind as you study these arguments. Observe the principle in your actual selling practice. Here follows an outline of the most to be expected objections, together with the suggestions for dissolving them.

The Prospect Who Says: "Too Expensive"

Don't make the mistake of arguing against that declaration because that will not help you at all. They doubtless are honest in their belief, due to their having a clearer understanding of the cost of the improvement than of the benefits made possible thereby.

Handle the problem rather from this angle by saying something like this: "Viewed from your standpoint, I don't blame you for feeling that the job's too expensive. But that's because you are too easily pleased. You don't expect enough for your money. So, naturally the job appears too costly. But just let me show you what you actually get for your money." Then show them.

The Prospect Who Says: "My time is not so valuable"

Don't combat that statement—accept it. Say something that will convey the thought suggested by the following: "Well, the busiest women I know are those who always have time for everything. They actually do so much that they don't realize how very valuable their time is. So I guess I know what you mean. But here's a point upon which I know we are agreed: Anything that saves steps and labor and protects your good health is worth its weight in gold to you, isn't it?" (Ninety-nine times out of one hundred, the answer will be "Yes").

Then show how more outlets, by making possible a greater use of appliances, will save labor, and make possible the saving of fuel, food, money. Stress the patriotic necessity for such economies.

The Prospect Who Says: "Installing Outlets (or more Outlets) means that we then will have to buy more appliances"

Naturally, of course, you cannot reply to that statement until you know what appliances are in use to-day. So find out what appliances the prospect has. Then, if you can show wherein and how more outlets would make for the better use of those appliances, do so.

Then explain how much money progressive housewives put into electrical appliances last year, because of the added economy, convenience and utility their use affords. Then lead the prospect to say that she expects some day to have a complete equipment of electrical appliances also. That will be your cue to urge the advisability of having the necessary outlets installed at once, as the first step towards enjoying the benefits of those new appliances she has declared it to be here intention to buy.

The Prospect Who Says: "We only rent"

Find out, if possible, the duration of the lease and the terms regarding improvement and upkeep. If there is assurance of possession for a reasonably long period, you probably will be able to show that the proposed investment for wiring and outlets really boils down to an expenditure of only a few cents daily. Classify that trivial expenditure with the price of a daily paper. Then show how many economies, advantages and comforts that piffling daily expenditure makes possible. Show that the value will be derived from the investment many times over before the lease expires and that going away and leaving the wiring and outlets as a fixture of the house can be done without any feeling of loss.

The Landlord Who Says: "My houses are always rented. Why should I go to the expense of installing Outlets?"

There's a lot that can be said in reply to that argument, but don't make the mistake of committing yourself to a particular line of attack until you know the facts. For instance, how frequently do tenants leave? How much of the gross rental income goes to pay fees to rental agents for securing new tenants? How many such vacatings are due to just such inconveniences as those occasioned through lack of outlets? Would not the saving in fees to rental agents, and, also the added rental income secured through keeping the houses rented continuously or more nearly so, seem to offset many times the investment for wiring and outlets?

On the other hand, if his houses actually are rented all or nearly all of the time, the argument should be to show (1) the added convenience to tenants, and the consequent enhancement of property value; (2) keeping the equipment of the house on a par with that of the many other

rented houses that do have all such conveniences; (3) the greater ease with which property can be rented; (4) the opportunity to ask a greater rental income. Also, there is the opportunity to appeal to the owner's pride in his property, his desire to keep his houses on a par with the best, etc.

The Woman Who Says: "I don't want to have my house and routine deranged"

Agree with her at once—she's perfectly correct; no woman appreciates such annoyances as she probably has in mind. Then make the point that wiring and installing outlets is not a messy operation, that the work can be completed with hardly more confusion than attends, say, putting a new battery on the electric bell. Explain just how the work is done. Assure her that the work can be done while she is out shopping or visiting and that you will make yourself responsible for all that occurs in her absence.

The Woman Who Says: "No,—I think its dangerous to have those Outlets around where the children can get at them"

Go easy here; the woman has the safety of her children in mind, and you cannot afford to dismiss her scruples by pooh-poohing them. Show her rather how extremely improbable and difficult it would be for children who are too young to observe instructions about leaving things alone, to contrive so as to receive any hurt. Show her that the construction of outlets is such that it would require considerable ingenuity even on your part to manipulate things so as to receive any hurt.

Then commence your talk about the advantages of having plenty of outlets. Tell her of the many houses you have wired for outlets. Make a point of emphasizing how pleased such households were because of the opportunity thus provided to make better use of their electrical appliances.

The Prospect Who Says: "Yes, I wish we had more outlets but we don't wish to spend the money just now. Later we expect to have such work done"

If you are convinced that they lack funds, or if you feel that you might have difficulty getting your money—save time, loss and trouble for yourself by passing them up.

Otherwise, work on the assumption that they are not sufficiently sold on the need for outlets, or more outlets, as may be. Say something like this: "Of course, you know your own business best, but did you ever consider that it probably is costing you more not to have those outlets installed, than it would to have the job done? Remind them of Emerson's statement that "if people need a thing they pay for that thing whether they buy it or not." Show the saving in fuel, food, time, money, labor that would be made possible through the installation of outlets and the proper use of electrical appliances. Then explain the easy payment terms you are offering. Offer to look the job over and tell them just what ought to be done, in your expert opinion.

The Prospect Who Says: "Yes, our house is electric-lighted, but we have no appliances; so we do not need any outlets installed"

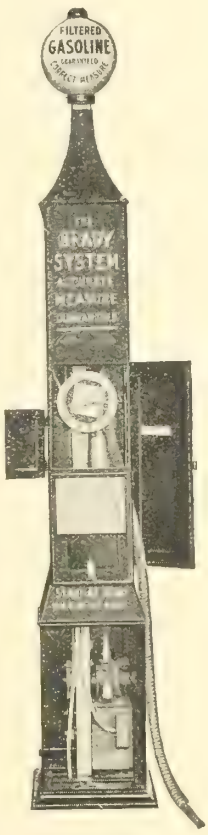
Don't, whatever you do, make the mistake of condemning that confessed lack of appliances. That would be fatal to your hopes. Handle the matter rather from the angle suggested by the following: "Is that so! I met a family yesterday who were doing without the convenience and economy of electrical appliances too. But when I explained to the lady just what it was costing her in unnecessary steps and labor, loss of time and actual money-loss, she decided that she could not afford longer to do without the use of outlets and appliances."

Then find out whether they use coal or gas for cooking, and how many there are in the family. That will give you the proper basis for explaining the use of electrical table appliances and an iron. If you cannot succeed in prompting them to decide to start in with such appliances and to have outlets installed accordingly, then try them on the electric cleaner and the washer. They will be almost certain to indicate a pronounced preference for some of the appliances you have mentioned; and as soon as you discover what one that is concentrate your canvass upon the advisability of having an outlet or more installed for the use of that appliance.

If you can get an order to go ahead, don't say anything then about putting in more outlets. Wait until you are on the job. Then explain (at that time) how advantageous it would be to have more outlets installed then and there while you have your tools and are on the premises.

Motor Driven Visible Measure Gasoline Dispenser.

The incidental losses in the vending of gasoline are claimed to be eliminated by the use of a visible measure gasoline dispenser. The accompanying illustration shows the general appearance of the apparatus opened up to show the mechanism. The pump is driven by a Westinghouse ½-horsepower motor, entirely enclosed in the base in accordance with the rules of the National Board of Underwriters. The dispenser visibly delivers a full gallon for every gallon ordered. When the wagon delivers gasoline to the garage, the tank gauge shows accurately the full quantity obtained. Every gallon drawn from the tank into the dispenser is shown on the tank register, which can be checked with the tank gauge. Thus, both the public and the garage owner are protected from loss. Furthermore, the oil companies are enabled to make more rapid deliveries than by measuring cans from wagon to garage tank where this dispenser is installed.



Condensers, pumps, cooling towers, etc. is the name of Bulletin 112-A just published by the Wheeler Condenser & Engineering Co., Carteret, New Jersey.

National Association Merchandising Committee's Report*

The committee's report is particularly intended to help the many contractors who are trying to decide whether it is to their interest to go into the merchandising of electric service appliances. The problems are many and the committee has analyzed the subject carefully with a view of assisting our members in coming to the proper decision.

The committee would recommend that if one or more of the following conditions exist that the wiring contractor should not at the present moment consider going into the merchandising of electric service appliances.

If the wiring contractor's organization is at present kept busy with wiring installations.

If the contractor lacks capital,

If he has not a proper location for a merchandising store.

If he cannot himself give sufficient time to get the merchandising store started in good shape before turning it over to an employee.

Or, if the local lighting company is not on a fair merchandising basis. The local lighting company's policy on lamps and electric service appliances should be thoroughly analyzed.

It is the committee's recommendation, however, to the wiring contractor, if he decides not to go into the merchandising to be sure and get back of every local merchandising campaign, because of the fact that he is bound to get more wiring business on account of the installation of electric service outlets, which means larger feeders, more circuits and, besides, the electric service outlets in the home, office and factory. There is no reason why the wiring contractor, after making an installation, should not also supply the electric service appliances, even if he has no show room, because he must undoubtedly have the confidence of his customers by the time the building is wired, and if he has faith in his own ability as a salesman and the material he is selling he can certainly get the customer's order for the electric service appliances, and with the proper demonstration give the customer the benefit of his experience in the electric business while making a fair profit for himself on the sale.

In urging upon our members the value of the merchandising of electric service appliances, it is not intended that this should include the intensive sale of electrical wiring supplies without their installation, or in other words, compete with the present jobber on sales of supplies to the consuming public, who themselves make the installation. This, in the opinion of the committee would be a grave mistake and would make conditions worse instead of better for the contractor. It would be far better to support the local jobber, who, in consideration of doing a larger wholesale business with the contractor, would not be so keen for the retail business, which they are getting from the consumer as industrial business, but which under any name has, and is to-day, demoralizing the electrical construction business and to a great extent preventing the closer co-operation of contractors and jobbers. It should be the aim of the contractor-dealer to merchandise the wiring supplies installed. There is no doubt that this will make for more complete electrical installations, which again help the sale of electric service appliances which means better electric service to the public.

For those wiring contractors who are contemplating getting into the merchandising of electric service appliances, we have the following suggestions and hope our members will give careful analysis to each suggestion before concluding to take up merchandising.

Market.

Our members should first analyze the potential market in their town or city, or if they are located in the residential neighborhood retail district, the question of the business that they can get from such a neighborhood.

Here we might say that we have it from the best authority that there is less than one appliance to every residential connection, and that there should be not less than $150 f electric service to every residential connection.

We recommend that our members first write to the Society for Electrical Development, 29 West Thirty-ninth Street, New York City, and ask them for their pamphlet, "Three Thousand Uses for Electricity," and also ask the Society of what value it could be to them in the electrical merchandising business. Also subscribe to the electriacl trade papers which are making a specialty of boosting electrical merchandising.

The committee advises also to take up the advisability of going into the electrical merchandising business, with the sales manager of the local lighting company. It is the opinion of your committee that the lighting company would, and should, co-operate in every way in backing up the electrical contractor-dealer in the town or city to the end of making a more thorough application of electric service in the home, office, or factory, because, in the opinion of the committee the use of electric service makes business not only for the central station, but for every branch of the industry, including both the wiring contractor and the dealer.

Location.

As to the location there is no argument but that the more central the location the better, in the retail district of the town or city, or the residential neighborhood retail district. A small store in the heart of the retail district may make more money for our member than the large store out of the retail district.

Capital.

Our members should appreciate that it requires capital to establish a merchandising store, and the most careful analysis should be given to the question of sufficient capital for the equipment of the smallest or the largest electrical merchandising store. Here the committee can only suggest to go slow and careful with the greatest anaylsis before coming to any decision. It is not good business to rob the wiring contracting business to get the necessary capital to go into the merchandising business. There, however, is no reason why a contractor with small capital with a nice, clean store room, with his wiring supplies nicely arranged on shelving, and his merchandising stock on exhibit in a nice, clean show window, and with either himself or a person in charge who can explain the electric service appliances to the prospective customer should not make a success of merchandising. A dealer of this kind may make a much better start than if he goes into too great expense to start with.

Equipment.

Next to a good location the proper arrangement of the entrance and show window is of vital importance, and again,

*Read before the Cleveland Convention by Fred B. Adam, chairman.

the proper layout and equipment of store fixtures. The committee suggests that both the wall cases and the counter cases should be so arranged that they can be extended or increased in number as the business justifies.

It is good business to have the staple appliances in the rear of the store. Consideration must be given to the large samples, like washing machines and ironing machines, that are shown to the best advantage when not too much crowded.

Here we wish to impress upon all of our members the value of keeping their store clean, including the floors, store fixtures, samples and by all means do not overlook the show window. Again, do not allow the wiremen or helpers to use the merchandising store as a proper place to accumulate the supplies for their jobs, or to loaf around while waiting to be placed on the next job. Remember that the majority of your customers for electric service merchandise will be the lady of the house, who will appreciate to the fullest extent the best service you can give.

Publicity.

Publicity is the life of any business, and our member must, in analyzing his capital requirements, set aside a certain amount of money for publicity. However, as to how the publicity should be arrived at is entirely a local problem, and must be worked out in each locality, whether it be a town, city or neighborhood residential retail district. The committee would suggest in a town or city, newspaper advertising, or if in a residential neighborhood keeping the store open nights with an attractive show window, as well as letters to the residences of the neighborhood, and if possible house to house solicitation.

Method of Doing Business.

Your committee recommends that our members send to the McGraw-Hill Publishing Company, Tenth Avenue and Thirty-sixth Street, New York City, for their book on "How to Sell Electrical Labor Saving Appliances," and to the Society for Electrical Development, 29 West 34th St., New York City, and ask for their pamphlet on "How to Sell an Idea," also to very carefully analyze all electrical merchandising methods by visiting the department and other merchandising stores, and never overlook any opportunity of visiting merchandising stores in other cities and towns, particularly the central station show rooms. Your business methods have a vital interest in the success of the business.

The problem of credit sales must be thoroughly analyzed by members. Credit should be given with the greatest care. There is no doubt it makes for greater business, but it also can break the contractor-dealer quicker than any other venture we known of. The committee therefore always recommends if possible a cash sale, unless customer is positively known to be good credit. It is a good plan to join the local credit association, or in a residential district see the other storekeepers.

Credit should never be given for over thirty days, in fact, good business calls for not over thirty days' credit with a trade acceptance, as advocated by the Federal Bank Board.

The committee acknowledges a problem in the question of deferred or time payment terms for the high cost appliances. There is no doubt that time payment terms greatly assist in the introduction of the high-cost appliances, but at the same time makes an unbearable burden to our members with small capital. The committee, however, suggests that in considering the time payment terms our members should analyze the following: The regular selling price, plus 10 per cent to pay for the extra cost on deferred payment accounts, and that no article be considered on time payment terms of less than, according to conditions, $5.00, and if possible $25.00, and that the first payment down should be not less than 10 per cent, if possible 20 per cent, with all other payments not less than 10 to 20 per cent. We also suggest that our members get acquainted with the local methods in handling deferred or time-payment business.

Delivery.

Our members should carefully analyze the necessity and cost for delivery system, and consider that in these war days it is both right and proper to keep the delivery cost as low as possible. Good service to-day does not necessarily call for unnecessary delivery cost.

Demonstration.

Your committee urges upon you to give a careful analysis to the value of demonstrating every appliance in the most careful and complete manner. We suggest that our members make a personal investigation by taking home and trying out themselves the various appliances. It has been said time and again that a sale is not complete until the customer is satisfied and has paid the bill, and your committee is satisfied that the more carefully the appliances are demonstrated the earlier will be a satisfactory condition in electrical merchandising. Here we wish to suggest to the wiring contractor that it is not good business on his part to take an order, for an example a washing machine, and have the jobber's salesman do the demonstrating. We have heard of several instances where such demonstration made a heap of trouble to the wiring contractor and caused him to never try and make a sale again. He should make the demonstration himself and he will know the trick of making the next sale.

Records.

Your committee suggests that you write to J. E. Sweeney, chairman of our Committee on Credit and Accounting, for suggestions on keeping the accounts of the wiring business and merchandising separate, also how to keep records of the various classifications of sales for electric service appliances, for example a separate account of lamp sales, household irons and small appliances, cooking utensils, vacuum cleaners and washing machines. Such records will greatly assist our members, as well as your committee, in investigating the cost of overhead for each classification of merchandising.

It is also suggested that records be kept of all sales in the above classifications on the question of current consumption basis, which is of value to your committee as well as the central station.

Competition.

If our members start out with the idea "that he profits most who serves best" the question of competition will not be such a serious one, particularly if they would analyze the common remark of a prospective purchaser that they can purchase a certain article at so and so for less money. This is the most vicious and barbarous kind of competition, and in a great majority of cases when run down to a final decision is found to be only the customer's desire to purchase at a cheaper price. The committee would suggest that the best quality of merchandise has the least competition, and if regularly sold at the manufacturer's selling price is more staple than if left to the judgment of the particular dealer who is making the sale. This does not, however, mean that only one price articles should be considered. It is a known fact that first quality articles are made by several manufacturers, who differ in the price, which is always an advantage to the dealer in advertising as well as selling to the customer. However, we believe that close co-operation between Association members and the central stations will eliminate the bugbear of competition to the greatest extent.

Co-operation if less talked about and more applied, we

believe would spell success for the electrical appliance merchandiser in the shortest possible time, and your committee urges upon you that this co-operation is positively necessary in the electrical industry, and must include all branches of the industry as included in the various conditions of each locality. It must include the closest co-operation between the contractor dealer, jobber and central station, and if possible the manufacturers, or representatives of manufacturers.

Your committee suggests a Co-operative Committee, consisting of one or two representatives, of each of the above branches of the industry be formed to take charge of the local merchandising campaign and that this Co-operative Committee be continued as long as the necessity continues in the locality.

Data and Sales Book Pages.

Your committee hopes in a very short time to co-operate with the Committee on Data and Sales Book to the end of furnishing our members with all kinds of information on electrical appliance merchandising on pages for the Data and Sales Book.

Costs and Accounting for the Contractor*

Much stress has been, and properly should be, laid upon the fact that accounting is a real fundamental of all successful business. With this in mind your Executive Committee determined that the subject should be developed and that an educational movement should be fostered that had as its object the eventual adoption of a standard classification of accounts for electrical contractors and dealers, and possibly the recommendation of a complete bookkeeping system that would meet the needs of some of our members. You can readily appreciate that it would be impossible to submit a complete bookkeeping system that would meet with approval or adapt itself to the peculiarities of all our members' business. We do anticipate that we can design and submit a simple and accurate system of forms and instructions that will meet the requirements of the average electrical contractor.

The average electrical contractor when asked how he keeps track of the cost of his contracts and the cost of conducting his business appears rather surprised that so simple a question should be asked of him, yet, when confronted with specific items and details admits that he has no special system or method. One of the objects of the standard classification of accounts which we are submitting is to get all contractors, large and small, to designate these specific items and details in the same manner and by the same account name. Then we will be able to collect and disseminate information for comparative purposes that will have a tangible value to everyone in the industry.

In order that this work might be brought to the favorable attention of the various branches of the electrical industry, your Executive Committee authorized my conferring with the several branches of the industry and I am glad to give you the results of that conference, to date.

At a joint committee meeting held in Chicago we agreed upon the following capital accounts:

CURRENT ASSETS—
- Cash in Bank .
- Petty cash fund.
- Certified check Account.
- Accounts Receivable.
- Trade Acceptance Account.

Inventory Account.
- Wiring Supplies.
- Fixtures and Glassware.
- Appliances.

Fixed Investments.
- Furniture and Fixtures.
- Tools.
- Automobiles—Trucks.
- Building.
- Real Estate.

Prepaid Values.
- Insurance.
- Deferred charges to income.

LIABILITIES—
- Capital Account.
- Capital Stock.

Current Liabilities.
- Accounts Payable.
- Notes Payable.
- Trade Acceptances.
- Accrued Taxes.
- Accrued Interest.

Reserve Accounts.
- Reserve for Loss on Notes and Accounts Receivable.
- Reserve for Depreciation on Furniture and Fixtures.
- Reserve for Depreciation on Autos and Trucks.
- Reserve for Depreciation on Tools.

CURRENT PROFIT AND LOSS ACCOUNT.

SURPLUS ACCOUNT.

In addition to these capital accounts we also agreed on the following designation of expense items:
- Salaries—Management.
- Salaries—Sales.
- Salaries—Office.
- Salaries—Shop.
- Commission and Bonus Account.
- Rent, Heat and Water.
- Light and Power.
- Telephone and Telegraph.
- Fire Insurance.
- Liability and Compensation Insurance.
- Advertising.
- Taxes.
- Interest on borrowed capital.
- Auto and Truck Expense—or Delivery.
- Association Membership.
- Office Expense.
- Traveling Expense.
- General Expense.
- Repairs and Upkeep.
- Losses on Bad Accounts.
- Depreciation—
  - Merchandise.
  - Furniture and Fixtures.
  - Tools.
  - Autos and Trucks.
- Service Account.
- Shop Expense and Supply Account.

Clear and concise definition and description and all that pertains to the above-mentioned accounts is now being formulated and shortly, I hope, will be transmitted to you through the means of our Data Book. This information will also be supplemented by various articles in electrical trade papers.

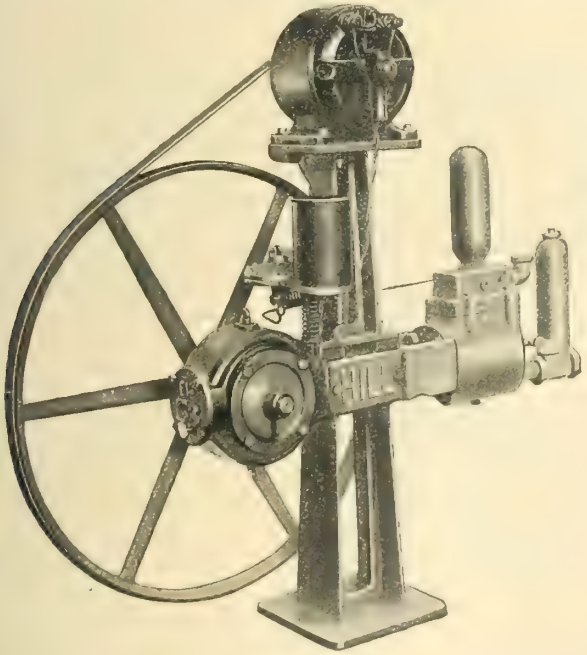
*Report presented at the Cleveland Convention by the Chairman, Mr. J. E. Sweeney.

Tuesday Evening, October 15th

Contractor-dealers, jobbers and manufacturers are specially interested in hearing Mr. W. L. Goodwin on Tuesday evening, October 15. It is expected that several hundred electrical men from all over the province will be present at the dinner at the King Edward Hotel, Toronto, on that occasion, when Mr. Goodwin will explain his plan of co-ordinating the various elements in the electrical industry to the end that "more electricity may be used in more ways by more people." Keep the date in reserve—Tuesday evening, October 15. Every electrical man is not only welcome but urged to be present. Hon. Frederic Nicholls will preside.

Automatic Electric House Pumps

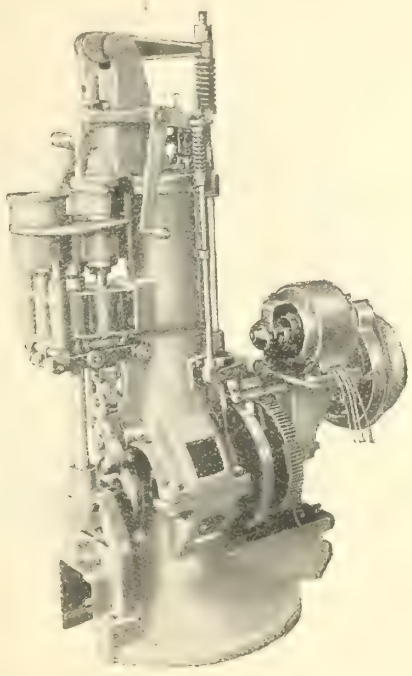
The accompanying illustration shows an automatic electric house pump for pneumatic service. The pump is compactly arranged so that it occupies little floor space and can be mounted on a sub-base adjacent to the tank or at a distance as desired. The pump is of the horizontal double-acting type, claimed to be the most successful for drawing water by suction and forcing a continuous stream against pressure. The cylinder is brass fitted with ample water passages, valve area and air chamber. Crank and cross heads work in an oil bath in an oil tight case. A Westinghouse motor is mount-



ed on the top of the pedestal, as shown, where it is away from dampness, oil, or floor dirt and convenient for starting and stopping the motor which maintains the water pressure in the system above a fixed value. The motor is connected directly to the electric light circuit in the house. The pump forces water into the pneumatic tank compressing air therein, as required. The expansion of the air drives water through the house pipes to the kitchen, laundry, bath, etc., in a steady continuous stream. When the pressure in the tank reaches the desired maximum, the motor and pump automatically stop until the water is drawn off enough to reduce the pressure to a predetermined setting of the switch. To prevent the tank from becoming water logged, an air valve is provided, which, when opened, allows air to be forced into the tank with the water.

Piston Vacuum Machine

This piston vacuum machine, used by canners and preservers, combines a tumbler sealing machine and a vacuum pump in one simple unit, requiring only a ¾ horsepower Westinghouse motor to operate it. It is claimed that an ordinary operator can seal as many as fifty tumblers a minute with this machine, with less effort than formerly, because of the construction, which enables him to perform the work of unloading and loading one pocket while the machine removes



the air from the other pocket, and seals it. The degree of vacuum desired in each package can be regulated instantly. Broken tumblers are reduced to a minimum, since the sealing strain is applied through compensating springs which seal each jar alike, although one may be larger than the other. The variation is taken up in the spring. Changes from one size to another can be made easily in two or three minutes. The machine is made in two types, for sealing tumblers, from 2½ to 6 inches in height, by the Anchor Cap and Closure Corporation, Brooklyn, N.Y. The two-pocket type is used for dry or pastry products, and the four-pocket type for liquid or semi-liquid products which are apt to spill or splash. Either type is arranged to give three speeds, as desired.



Model Laundry in new London Hydro Show Ro

Current News and Notes

Meaford, Ont.

Mr. David Robinson, electrician for the Georgian Bay Milling and Power Company, Meaford, Ont., met death recently by electrocution.

Montreal, Que.

July figures for the Montreal Light, Heat and Power Company just to hand, show gross earnings for the first quarter of the fiscal year amounting to $2,567,039, representing an increase of $267,161 over the corresponding period last year.

The gross earnings of the Southern Canada Power Company for July amounted to $41,265 and the net, $18,491, an increase of $7,037 and $4,318 over the corresponding month in 1917.

Orillia, Ont.

Owing to low water in the Severn River the Orillia Water, Light and Power Commission have been forced to curtail power supply in some quarters and also cut off the domestic current at times.

Perth, Ont.

A twelve-year-old boy was instantly killed when he touched a fallen electric wire in Perth, Ont.

Peterboro, Ont.

Petitions are being prepared and will be presented to the Hydro-electric Commission in the near future requesting extensions to the street railway in Peterboro, Ont.

Rainy River, Ont.

A by-law authorizing the town council of Rainy River, Ont., to purchase the plant and equipment of the Rainy River Electric Light and Power Company, has been carried by the ratepayers.

Regina, Sask.

An increase of 22 per cent. is reported in the passenger traffic on the Regina municipal railway over he corresponding month of last year. The total number of passengers carried was 446,000 and the receipts were $21,400.

An increase of approximately 15 per cent. in wages, and other concessions, has been asked by the electrical workers in the Regina municipal power house and street railway department.

Saskatoon, Sask.

The Lemery-Denison Electric Limited, Saskatoon, Sask., have been incorporated.

Sherbrooke, Que.

Donohue and Audet, electricians, Sherbrooke, Que., have registered.

Toronto, Ont.

Statistics covering the operation of the Toronto Civic Railway during August show an increase of 229,993 in passengers carried and $5,094 in revenue, over the corresponding month in 1917. The month's revenue was $28,731 and the number of passengers 1,719,364.

The electrical workers in Toronto, according to the International Union of Electrical Workers, very much desire a licensing board so as to promote a very high general proficiency among the members of their trade. The idea is to have the government appoint a licensing board comprising five members; one from the Hydro-electric Power Commission and two each from the Electrical Workers' Union and the Electrical Contractors' Association.

Trail, B.C.

The West Kootenay Light and Power Company are taking immediate steps toward the construction of a hundred mile transmission line from Greenwood to Copper mountain, in the Similkameen country, to supply power to the Canada Copper Corporation. The present power line ends at the Greenwood smelter of the Canada Copper Company. The new line will furnish power for the operation of a 2,000 ton mill and mines near Princeton, although it will be some time before the installation is completed.

Vancouver, B.C.

The ratepayers of Vancouver, B.C., will be asked to vote on the 6 cent fare question in the near future.

Winnipeg, Man.

A board of conciliation will be appointed to look into the matters at issue between the employes and the Winnipeg Electric Railway Company. The demand is for wage increases to 47 cents an hour for the first three months; 55 cents for the next nine and 60 after the first year, overtime to be paid time and a half, the present nine-hour day to remain.

An item in the Winnipeg Free Press states that an automatic telephone system for that city is contemplated.

Windsor, Ont.

Negotiations are being carried on by the Ontario Hydro-electric Commission with the Windsor, Essex & Lake Shore railway for the purchase of the company's system, which operates between Windsor, Kingsville and Leamington, in addition to serving prosperous rural communities. The price asked by the company is said to be $1,000,000. Mayor Tuson, of Windsor, believes that Kingsville-on-the-Lake can be made the lakeside resort for not only the border communities, but Detroit and other Michigan cities.

Obituary.

The death occurred recently of Mr. Alfred Hanley, manager of the Kingston office of the Great Northwestern Telegraph Company. He was said to have been one of the best telegraphers in the country and had been manager of this office for the last 15 years.

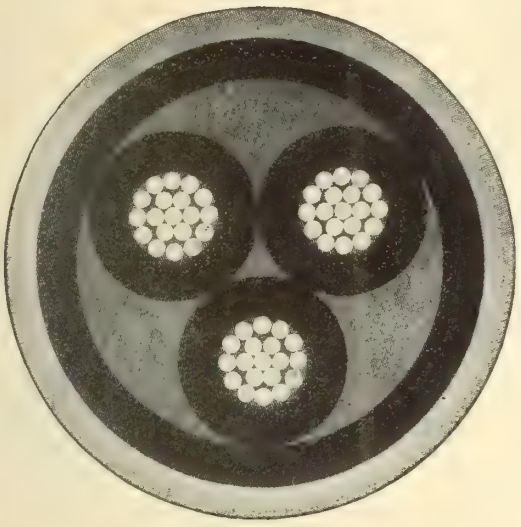
William Henderson, electrical engineer, died recently in Quebec City following an accident whereby he fell into the hold of a ship. Mr. Henderson was in charge of the Government electrical work in connection with shipping at Quebec. He was a native of Scotland and had been in Canada nearly twelve years.

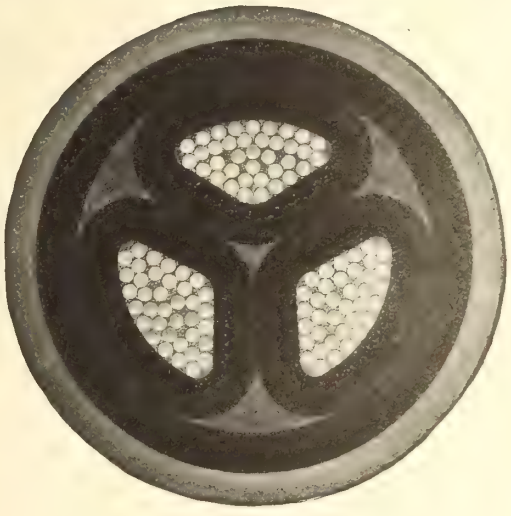
New Book

How to Sell Electric Labor-Saving Appliances—compiled by Electrical Merchandising; McGraw-Hill Book Company, Inc., New York, publishers. A compilation of 119 useful plans for the electric store—window displays, show cases, shelves and table arrangements, advertising, prospects, training clerks, planning sales and management. A valuable book for every dealer in electric merchandise as there are tested plans which have proven their value in dollars and cents and, moreover, are for the most part very simple in application. The book is illustrated; size 5 x 7 inches, price $1.00.

PHILLIPS' CABLES

as supplied to the Toronto Hydro Electric System





These illustrations show cross sections in the original size of cables recently supplied to the T. H. E. System and reordered by them for further extensions. The specifications are as follows.—Conductors composed of 37 strands each, .082 in. diameter. Thickness of dielectric on each conductor, .210 in. Thickness in belt, .210 in. Thickness of lead sheath, .160 in. Overall diameter, 2.61 in., 250,000 C.M. Three Conductor, Paper Insulated, and plain Lead Covered Cable for 13,200 volts. We can supply you with wires and cables of any size for Power, Lighting, Telephone, Telegraph, etc.

Write us for detailed information.

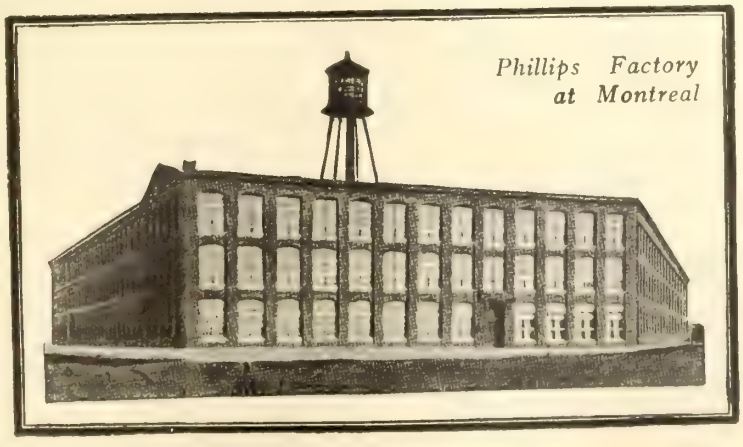
NOTE.—Specification of cable in left-hand cut: 3/0 B. and S. Three conductor. Each conductor 19 strands, each .094 in. diam. Thickness of dielectric on each conductor, .21 in. Thickness of dielectric on belt, .21 in.. Thickness of lead sheath, .15 in. Overall diameter, 2.60.

Specification of cable in right-hand cut: As stated in copy.

Eugene F. Phillips Electrical Works, Ltd.

Head Office and Factory: MONTREAL

Branches: Toronto Winnipeg Regina Calgary Vancouver



Phillips Factory at Montreal

POSITIONS VACANT

WANTED
Competent Electrical Wiremen

The Electric Taxicab

By A. Jackson Marshall.

The electric taxicab installations in several American cities continue, after protracted and exacting tests, to give excellent service. Their cost of operation is considerably below that of gasoline taxicabs, and none of this type approach the "electric" in quality, of service, including safety, cleanliness, noiselessness, dependability, absence from obnoxious odors, and ability to negotiate quickly dense traffic encountered in thickly populated urban districts.

Shortly prior to our entrance into the war, plans were maturing rapidly for the inauguration of extensive electric taxicab service, in New York, Philadelphia, and other large cities, the initial installation in New York City to have consisted of five hundred such cabs which were to have been augmented to meet the inevitable demands which were anticipated. When financial conditions will permit, this development will be launched.

Electric taxicabs have been used successfully in several European cities for a number of years, in some of which preferential rates applied in the matters of licenses and taxes as it was realized that electric taxicabs, and their operation, possessed features of advantage to the municipalities.

While several proposed electric taxicab installations in Europe are pending, advices received the middle of June state that owing to the scarcity of petrol (gasoline), a service of electric motor-cabs (taxicabs) is about to be inaugurated at the Hague, Holland, and which may, by this time, be in operation.

In passing it will be of interest to note that in Detroit, the birthplace of the modern, successful electric taxicab, that these electrical conveyances are operated during the day by women who discharge their duties very satisfactorily.

For Sale

100 H.P. Low Speed Induction Motor for 2200 volt, 3 phase, 60 cycle circuit. This is a large machine, having 44 poles and runs 158 R.P.M. on 60 cycle circuit.

The Stator is split, the lower half weighing 15 tons, the upper half 11 tons.

The rotor is 12·3 in. in diameter and weighs about 13 tons.

Montreal Water and Power Company,
P. O. Box 1617,
Montreal, Que.

PETRIE'S LIST

of New and Used

MOTORS

FOR IMMEDIATE DELIVERY

No.	H.P.	Phase	Cycle	Volts	Speed	Maker
1	100	3	25	550	480	Westg.
1	40	3	25	550	750	C. G. E.
1	30	2	60	220	1500	T. & H.
1	25	2	60	220	945	Westg.
1	25	3	60	2000	900	C. G. E.
1	20	3	25	550	1440	J. & M.
2	10	3	25	550	720	Westg.
1	7½	3	25	550	750	C. G. E.
1	5	3	25	550	720	Westg.
1	4	3	25	550	1400	Excelsior
1	3	3	25	550	1500	C. G. E.
3	3	3	25	550	1400	Excelsior
1	1	3	25	550	1400	Excelsior
1	¼	1	60	110	3400	Diehl.
1	¼	3	25	550	1500	T. & H.

Write Us for Prices

H. W. PETRIE, Limited
Front St. West - Toronto, Ont.



Rubber Covered Wires and Cables

FOR POWER, LIGHT AND TELEPHONE WORK

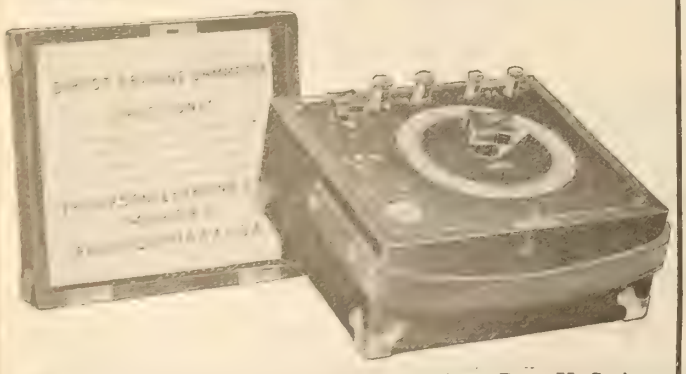
Incandescent Lamp Cord, Flexible Switchboard Cables, Special Cords and Cables for all kinds of Electrical Work.

Prompt Shipments from Canadian Factory.

BOSTON INSULATED WIRE & CABLE CO., Limited

Canadian Office and Factory, HAMILTON, ONT.

DIRECT READING OHMMETERS



Thompson-Levering Co., Philadelphia, Pa., U.S.A.

Tenders

A few dollars spent in advertising your proposals in

The Contract Record

would result in additional competition, which might save your city or town or your client many hundreds of dollars.

Friends of the Electrician

"ANTI-SULPHURIC" ENAMEL
The only reliable protection against the action of acid and chemical fumes.

"FERRODOR"
Rustproof elastic paint. Superior to Graphite or Red Lead. Defies all climatic conditions.

"DRIOROL"
Oil-proof Enamel. Dries quickly over greasy and oily surfaces. Not affected by lubricating or transformer oils.

"ARMOUR"
Fire-resisting paint, or colorless solution.

"ARMACELL"
Possesses the highest insulating qualities of any varnish on the market.

"OHMALINE"
Black, quick air-drying insulating composition. Also supplied for stoving, and as a solid insulating compound.

"SHAYDOLITE"
for coloring electric lamps. Used in the Royal Navy. Weatherproof. Dries rapidly.

"ARMABRON"
Bitumen protective paint, elastic, acid-resisting, weatherproof.

Made in London, England, by
GRIFFITHS BROS. & COMPANY
(Contractors to H. M. Imperial and Overseas Governments)
STOCKED BY
SPIELMAN AGENCIES, (Regd.)
Dealers in Electrical Specialties
Read Bldg., St. Alexander St. MONTREAL

Selections from Our Stock of Motors
3 Phase, 60 and 25 Cycles

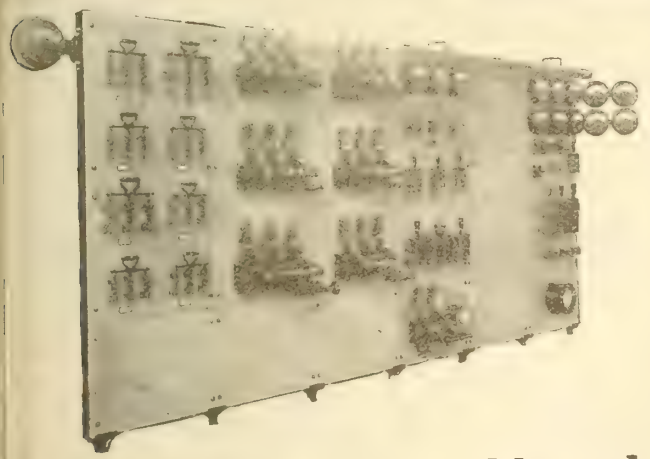
3 PHASE, 60 CYCLE MOTORS

Qu.	H.P.	Make	Volts	Type	Speed
1	¼	R&M NEW.	110		1700
1	½	G.E. NEW..	110	KT	1800
1	½	G.E.	110	I	1800
5	1	G.E. NEW .	220	KT	1800
1	1	Fbks. M. ...	440	B	1200
4	3	Wstgh. New.	220	CS	1130
2	3	R&M NEW.	220		1150
2	3	G.E.	220	KT	1800
1	3	G.E.	220	KT	900
3	3	G.E.	220	KT	1200
1	3	Cr. Wh.	220		1720
3	5	Cr. Wh. ...	220	Q	1720
1	5	Cr. Wh. ...	550	Q	1720
1	5	Wstgh.	220	CCL	1700
8	5	Wstgh. New.	220	CCL	1700
53	7	G.E. (motors only)	550		1200
1	7½-15	Cr. Wh.	220/440	865/1735	
2	7½	G.E. NEW .	220	KT	1800
1	7½	G.E. NEW .	220	KT	1200
6	7½	G.E. (motors only)	550	KT	1800
2	7½	G.E. NEW .	220	KT	900
2	10	G.E. NEW .	220	KT	1800
1	10	Wstgh.	220	CCL	1700
1	10	Wstgh.	220	CS	1150
1	10	Cr. Wh. with resistance type starter	550	Q	1800
1	10	G.E.	220	L	1200
1	10	Robbins & M	220	K	1750
1	15	Wagner New motor only ..	440		1165
2	15	Wstgh. New.	440	CS	1155
1	15	G. E.	220	I	900
1	15	Wstgh.	220		1155
2	15	G.E. NEW .	220	KT	900
2	15	Fbks. M.	220/440	KBV	1200
2	20	Wstgh.	220	CS	1160
50	20	Fbks. M.	220/440	KBV	1200
13	25	Wagner..	220/440	KBV	1200
2	30	Wagner New	220		850
1	35	G.E.	220	KT	600
1	35	Triumph.	220/440		900
1	40	Wagner NEW .	220/440	BP	850
1	40	Fbks. M.	220		900
1	35	G.E. NEW .	220	M	900
1	35	Westgh.	220		1170
1	40	Westgh. New	220	CS	870
1	50	Westgh.	220		850
1	50	Triumph	220		720
1	50	Allis-Chal. .	220		1750
1	75	Allis-Chal. .	550		690
1	75	Westgh. New	440	CS	720
1	100	Allis-Ch. . .	550		690
1	100	G.E.	550	K	600
1	100	G.E. NEW .	550	M	600
1	100	Westgh.	440		1200
1	125	G.E.	220	L	600
1	150	G.E. NEW .	220	M	580

3 PHASE, 25 CYCLE MOTORS

Qu.	H.P.	Make	Volts	Type	Speed
2	5	Wstgh.	220	CCL	705
1	10	Wstgh. New.	220	CS	750
1	12½	G.E.elev.type-high torque	220	KTE	750
15	15	Allis-Ch. . .	220		750
7	20	Allis-Ch. ..	220		750
1	40	Wstgh. . .	220	MW	695
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1	55	Wstgh.sl.rg. 30 cycles, complete. .	440		860
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No.	H.P.	Phase	Speed	Volts	Cycles	Starter	Make
1	50	3	750	550	25	yes	C.G.E.
1	60	3	750	550	25	[illegible]	[illegible]
2	50	3	750	220	25	yes	Lincoln
1	25	3	750	220	25	yes	Lincoln
1	25	3	750	220	25	[illegible]	[illegible]
1	15	3	1,080	220	25	[illegible]	[illegible]
1	10	3	1500	220	25	yes	T.H.E.
2	5	3	750	550	25		[illegible] CCL.
2		1	1500	110/220	25		Century & Wagner
1		1	1800	110	60		Fort Wayne
1		1	1800	110	60		Westgh.
1		1	1800	110	60		[illegible]
1	10	2	900	220	60	[illegible]	Fuller Wenstrom
1	15	2	1200	220	60	[illegible]	C.G.E.
1	10	2	variable	220	60	[illegible]	Westgh.
2	10	2	1200	220	60	[illegible]	[illegible]
1	10	2	1800	220	60		T.H.E.
1	7½	2	1200	220	60	yes	Crocker W[illegible]
2	5	2 or 3	1800		60	[illegible]	Westg. CCL. rewd.
2	5	2	1200	220	60	[illegible]	W[illegible] C.
2	5	2	1800	220	60	no	Westg. CCL.
2	1	2 or 3	1800		60	[illegible]	Westg. CCL. rewd
1		2	1800	220	60	[illegible]	W[illegible] CCL.
2	10	2 or 3	1200		60	[illegible]	W[illegible] CCL. rewd.
1	3	3	1200	220	60	no	W[illegible] CCL.
2	3	3	1800	220	60	no	C.G.E. [illegible]
1	20	3	900	220	60	[illegible]	Lincoln
1	7½	3	1800	220	60	[illegible]	Lincoln

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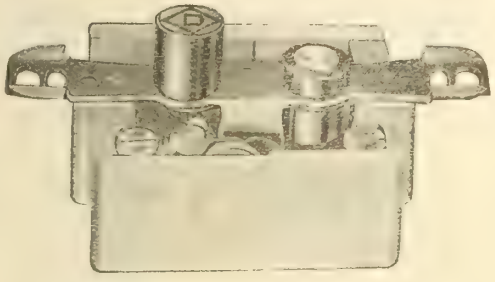
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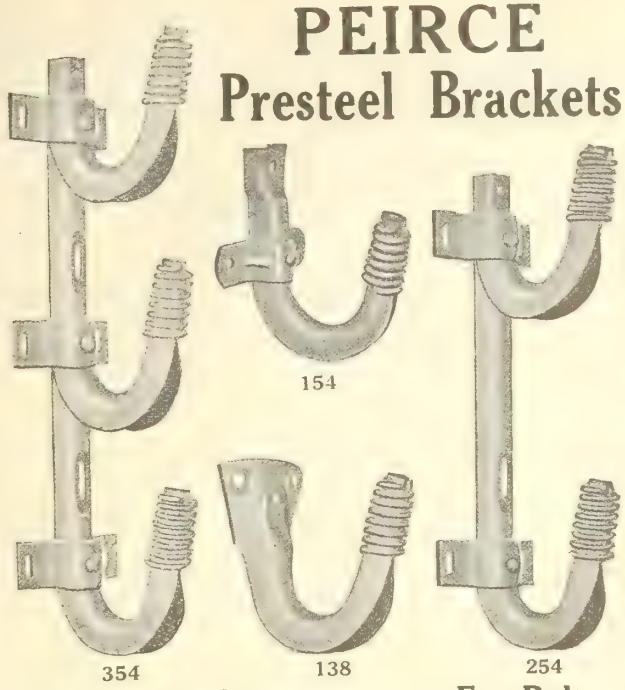
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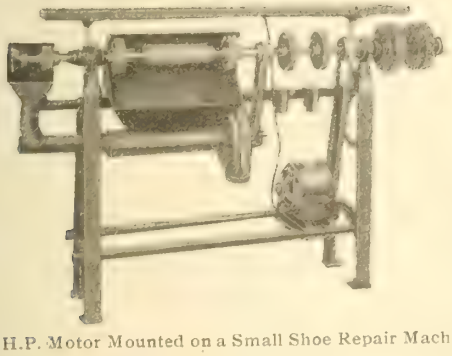
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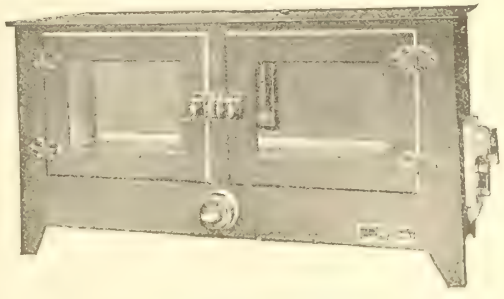
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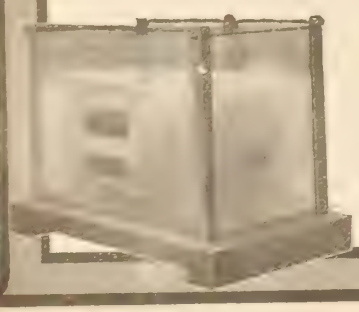
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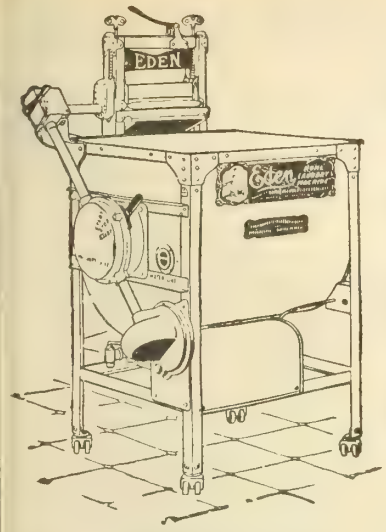
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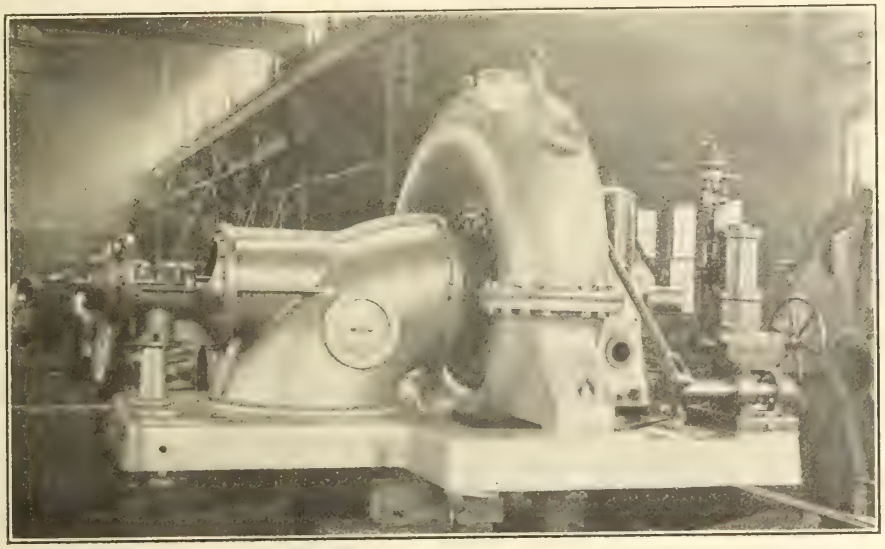
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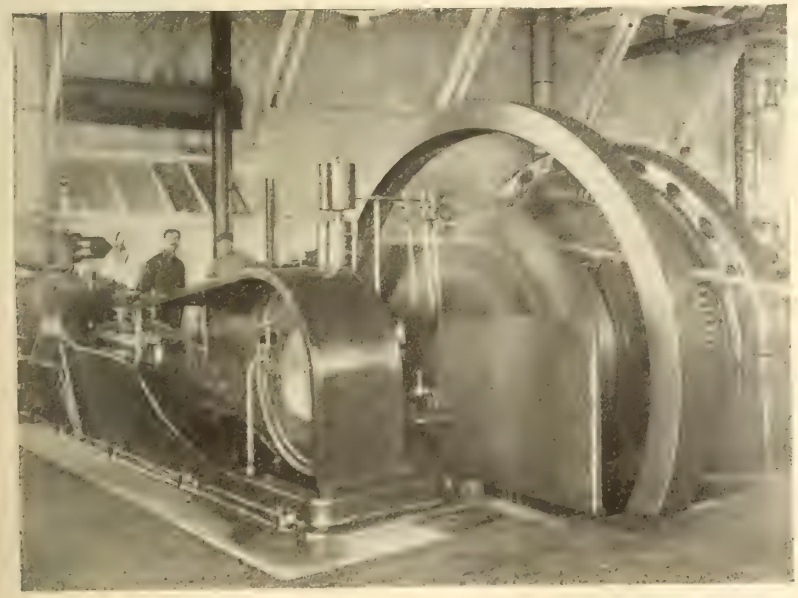
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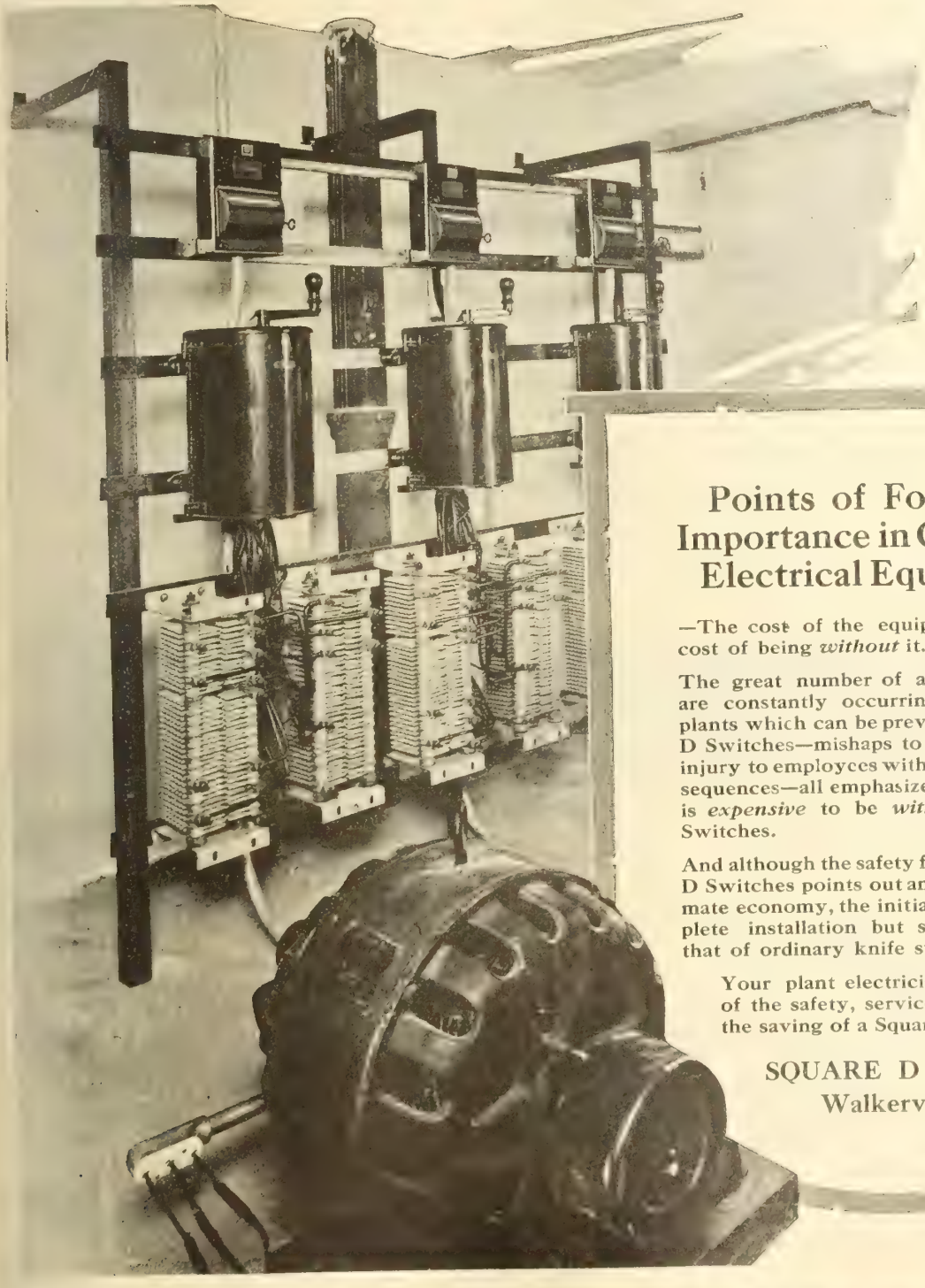
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THE ORIGINAL SAFETY SWITCH

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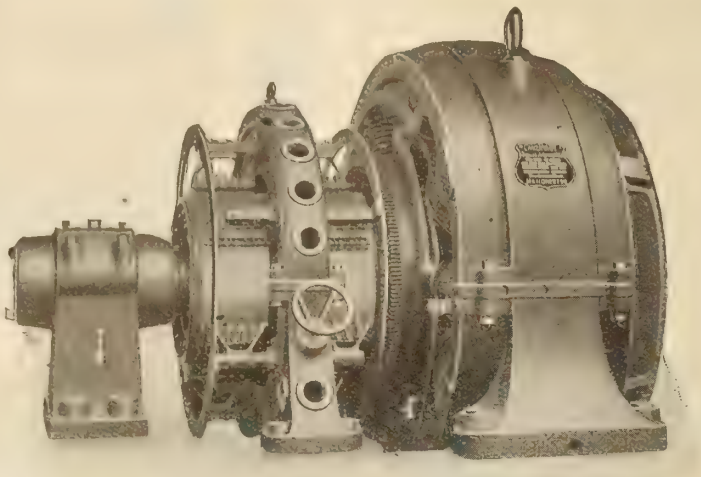
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Connections can never be broken. Fuses are solidly moulded in hard insulating material.
Neat in design, will not tarnish, and is practically unbreakable.

Approved by Hydro-Electric Power Commission



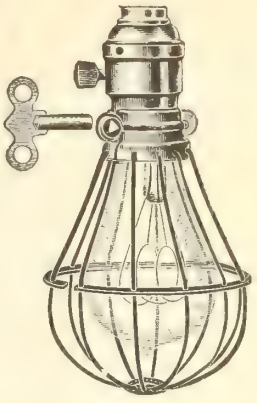
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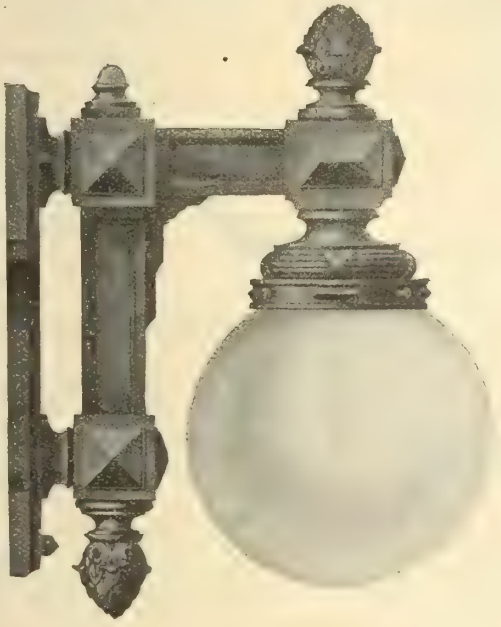
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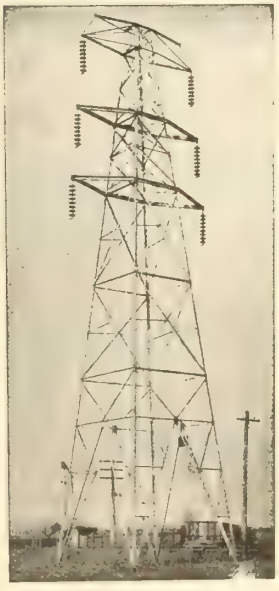
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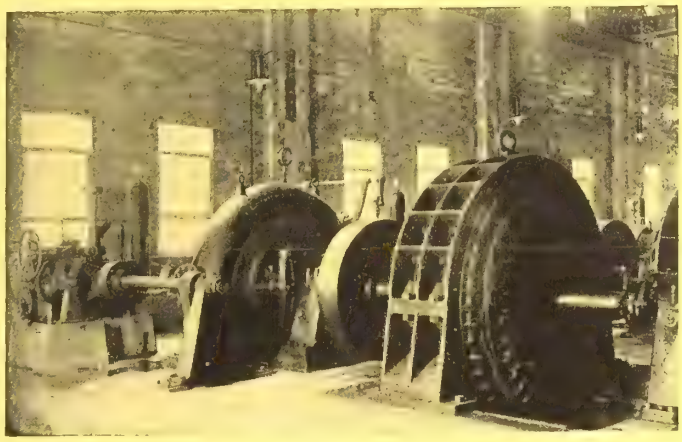
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A Lost Opportunity

As a wiring contractor, how many times have you turned down orders to repair the Motors or dynamos of your customers and let them send their work to the maker?

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Get our prices. We can save you 35% customs duties. A test purchase will prove that ours are the

Cheapest Storage Batteries in Canada

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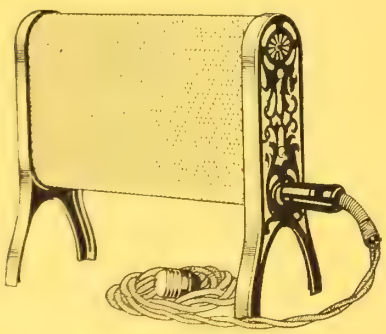
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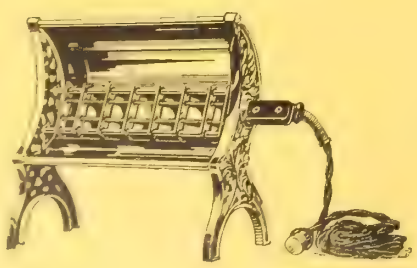
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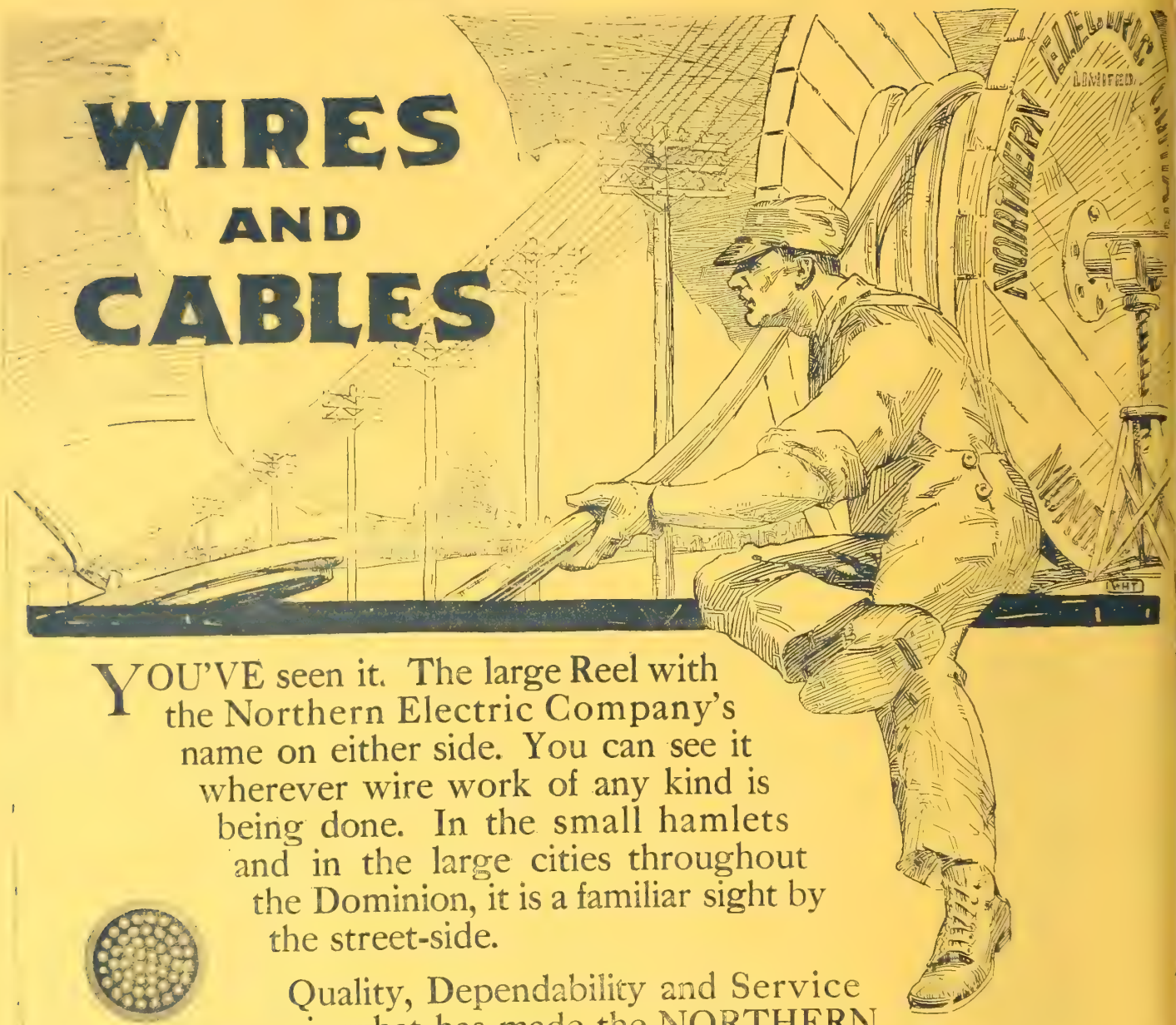
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Paper Insulated Lead Covered Telegraph Cable



Paper Insulated Lead Covered Telephone Cable



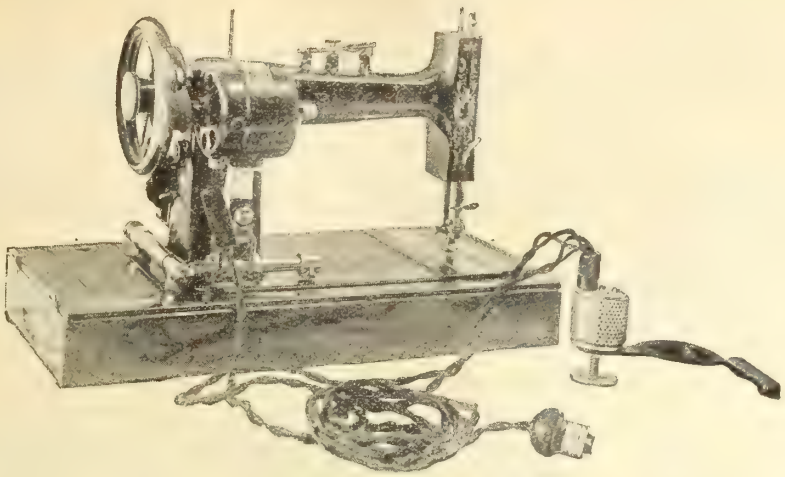
Paper Insulated Lead Covered Power Cable

Quality, Dependability and Service is what has made the NORTHERN ELECTRIC COMPANY LIMITED the largest manufacturers of bare and insulated Wire and Cable.

Our Nearest House will be glad to furnish specifications and prices on any type of bare or insulated wire and cable for electrical purposes—write us to-day.

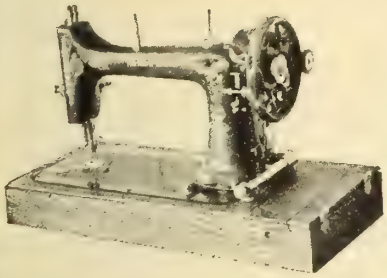
Northern Electric Company
LIMITED

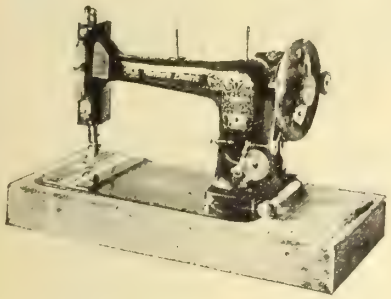
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TORONTO LONDON WINNIPEG
REGINA CALGARY VANCOUVER

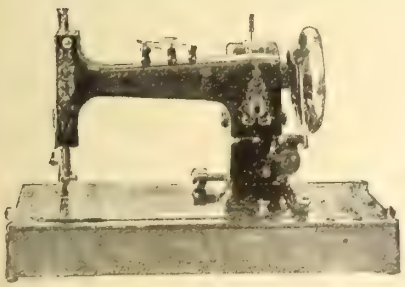


Every Woman Needs Its Help—Now

—but when the fall buying season comes, will you be ready?







Why Not Order a Good Supply of

Northern Electric

Portable Sewing Machines NOW?

Remember the greatest need for sewing by electricity is now, when the women of Canada are so extensively engaged in doing their own as well as a large amount of patriotic sewing work at home.

The Northern Electric Sewing Machine eliminates the tiresome, back-aching treadle work of the old method, and enables the operator to do twice as much sewing without effort.

The Northern Electric Sewing Machines are of the highest grade in design and workmanship, and carry a guarantee of complete satisfaction in every way.

Several different types are obtainable in both portable and stand style machines. You can secure either vibrating shuttle or bobbin type.

Closed view of our Portable Type Machines



Write our Nearest House for attractive proposition, descriptive literature, etc.



Northern Electric Company

LIMITED

MONTREAL
HALIFAX
OTTAWA

TORONTO
LONDON
WINNIPEG

REGINA
CALGARY
VANCOUVER



No. 222 TWO-WIRE METAL MOLDING

Lowest Installation Cost of any Metal Wiring System

On your next job refer to your Bulletin 101 and place your order with your jobber

NAT'S DEMONSTRATIONS—No. 6

After securing the Bushing—No. 277—Nat has snapped the base of the Molding—No. 222—into the base of the bushing. He has used no screws in making these connections, but the connections are secure and properly grounded. He has then laid in his wires, and is now ready to connect to a Device.

National Metal Molding Co.

1118 FULTON BUILDING
PITTSBURGH

Atlanta, Boston, Buenos Aires, Buffalo, Chicago, Dallas, Denver, Detroit, Havana, Los Angeles, Manila, New York, Paris, Philadelphia, Portland, Rio de Janeiro, Salt Lake City, San Francisco, Seattle, St. Louis

Canadian Distributors—Canadian General Electric Co., Limited

M 11

Made in Canada
Conduit

XCELADUCT

GALVANIZED

Orpen Conduit Co., Limited
Toronto

Your Car Signs are actually the first line of contact with your riding public — improve them, use these illuminated signs



Typical Keystone Type



Typical Hunter Type



Typical Keystone Type

They furnish an excellent inducement to ride, they advertise your service.

They make easy the re-routing of cars and the shifting of them from one barn to another.

They are complete in themselves. Parts are interchangeable. Uniform tension on Curtains. Curtains and mechanism removeable. Curtain interchangeable in types of equal length. No tools necessary to change curtain. Easily cleaned.

Write for complete data.

Electric Service Supplies Co.
Manufacturers
PHILADELPHIA 17th and Cambria Sts. NEW YORK 50 Church St. CHICAGO Monadnock Bldg.

Lyman Tube & Supply Co., Ltd.
Canadian Distributors
MONTREAL Lyman Tube Bldg. WINNIPEG 302 Donalda Block TORONTO 33 Melinda St.

HUBBELL


No. 3618

SPECIALTIES

MADE IN CANADA


No. 3664

We have established in Toronto a completely equipped factory for the manufacture of Hubbell Electrical Specialties.


No. 3667

The new Hubbell Plant has already begun manufacturing operations and will be prepared to make immediate delivery of Hubbell goods to Distributors and Retail Dealers throughout the Dominion.


No. 5950

There will be produced Hubbell Pull, Key and Keyless Sockets, Attachment Plugs and Receptacles, Shade Holders, Lamp Guards, Reflectors and other Hubbell Specialties which for years have had the approval and preference of the great majority of Dealers and Consumers in Canada.

HARVEY HUBBELL COMPANY

OF CANADA, LIMITED

TORONTO, CANADA


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No. 3431


No. 3330


No. 5765


No. 5702


No. 5735


No. 6915

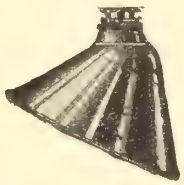

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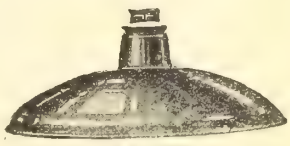
FACTORY

HUBBELL
REG U S PAT OFF

NOW FULLY EQUIPPED


ME1001 3445


MN100P


MD100H


No. 5691

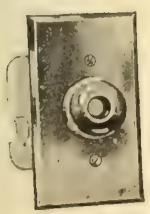

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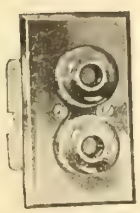
The Hubbell organization will take its place among the permanent and progressive industries of Canada, employing the best native skill and experience obtainable to produce Hubbell Canadian-made goods for Canadian trade.

Place your orders Now for Hubbell Specialties

Dealers, Contractors, Central Stations and Manufacturers in need of Hubbell goods can now secure ideal contact with the manufacturer. Orders for delivery of any Hubbell material anywhere in Canada will be given immediate and painstaking action.

HARVEY HUBBELL COMPANY
OF CANADA, LIMITED
TORONTO, CANADA

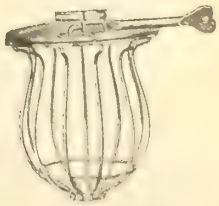

Cap No. 5421
Rec. No. 5547


Cap No. 5421
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No. 6147


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THE "TYPE S" PORTABLE WHEATSTONE BRIDGE



Useful in the Shop and Laboratory for the Measurement of Resistance Adapted for Fault Locations in Telegraph and Telephone Lines and Cables.

The Type S Bridge is a thoroughly practical instrument for shop and field use. Being complete in every detail it is ready at all times for immediate use. It is easily portable, its weight being but 8 pounds. The precision of adjustment of its coils (Rheostat 1/10 per cent., Ratio 1/20 per cent.) insures accurate measurements. The galvanometer, the weakest element of such an instrument, is unusually rugged. It is a separate element and may be removed for examination or repair by taking out two screws. The battery is of the ordinary "flash light" type, and renewals may be procured practically everywhere. The price is $66.25 net, f.o.b. Philadelphia, boxed for shipment.

Bulletin No. 530 describes this instrument.

THE LEEDS & NORTHRUP CO.

Electrical Measuring Instruments

4912 Stenton Ave. PHILADELPHIA, PA.



A "Galvaduct" Building

"GALVADUCT" and LORICATED

"GALVADUCT"

The most perfect interior construction conduit on the market.

Recognized as the standard of high quality.

Always specify Galvaduct or Loricated CONDUITS

"LORICATED"

A high-class interior construction conduit of the enamelled type, proof against acid or other corrosive agents.

If your jobber cannot supply you—write us.

CONDUITS COMPANY

LIMITED

TORONTO

Packard SERVICE TRANSFORMERS

Coils
Impregnated
by
Vacuum Process

Perfect
Insulation

Mica Barriers

Strong
Rugged
Durable



Steel Cases

Light in Weight

Easy to Handle

Will Not Leak

Unsurpassed
Appearance

Operating
Characteristics
The Best

WELDED STEEL CASES

We Build Large Power Transformers
Special Furnace Transformers
Current and Potential Transformers

THE PACKARD ELECTRIC CO., Ltd.

ST. CATHARINES, ONT.

Bank of Hamilton Bldg.
Toronto

Donalda Block,
Winnipeg

FULLMAN FLOOR OUTLETS

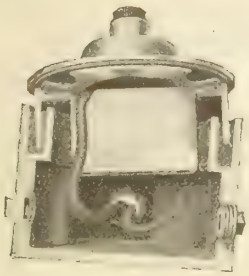
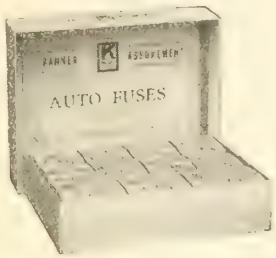


Fig. 104
Sectional view of No. 421 Outlet and No. 466 Nozzle with Bryant Receptacle No. 1363 and Plug No. 1110 mounted on lugs of Adjusting Ring.
Quarter Actual Size.

NO MORE BULLETINS
Our new complete catalog No. 33 just off the the press. Yours for the Asking.
"THE QUALITY LINE"

STEEL CITY ELECTRIC COMPANY
1207 1219 Columbus Ave. PITTSBURGH, Pa.

"BANNER" ASSORTED CARTON



This is a small, compact, carton giving a very good assortment at low cost. It contains 100 glass tubing cartridge type fuses, assorted as follows:

30 No. 1AG—20 amp. 15 No. 3AG—15 amp. 5 No. 5AG—15 amp.
5 No. 2AG—15 amp. 10 No. 3AG—20 amp. 5 No. 5AG—30 amp.
5 No. 2AG—20 amp. 5 No. 4AG—10 amp. 5 No. 6AG—20 amp.
5 No. 3AG—10 amp. 10 No. 4AG—15 amp. Total List $7.00

The fuses in all Killark assorted cartons are packed in little individual cartons, with contents clearly marked, preventing all possibility of error.

No charge is made for these cartons—the list prices represent the cost of the fuses only.

A POINT TO REMEMBER
Packing Auto Fuses in Cartons of 10 means increased Sales and Profits

KILLARK ELECTRIC MFG. COMPANY
ST. LOUIS, Mo.

Canadian Sales Agents

HATHEWAY & KNOTT, Inc.

Electrical Merchandise **120 Liberty Street, NEW YORK**

New York Headquarters for the Canadian Electrical Trade

Note That—The Cheapest STORAGE BATTERIES

are those made by the Canadian Hart Accumulator Company at St. Johns, Quebec.

Save at least 35 per cent. customs duties on Storage Batteries for every purpose. For lighting Farms, Towns, Country Houses, or for Electric Trucks,

May We Quote ? Our Prices to You

CANADIAN HART ACCUMULATOR

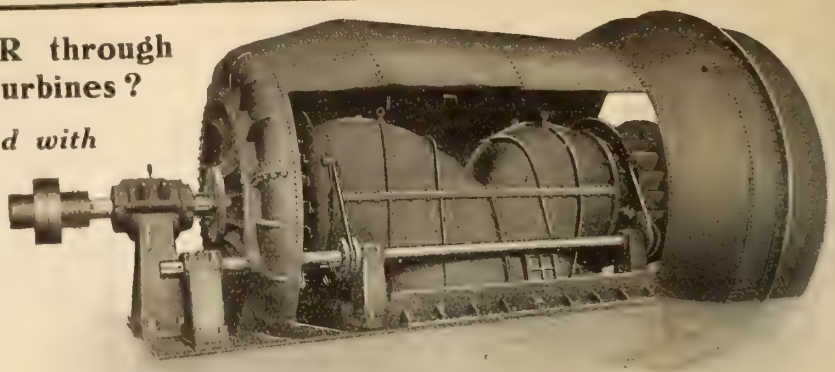
CO., LIMITED **ST. JOHNS, QUE.**

ARE YOU WASTING POWER through Inefficient and Antiquated Turbines?

Maximum Efficiency Assured with

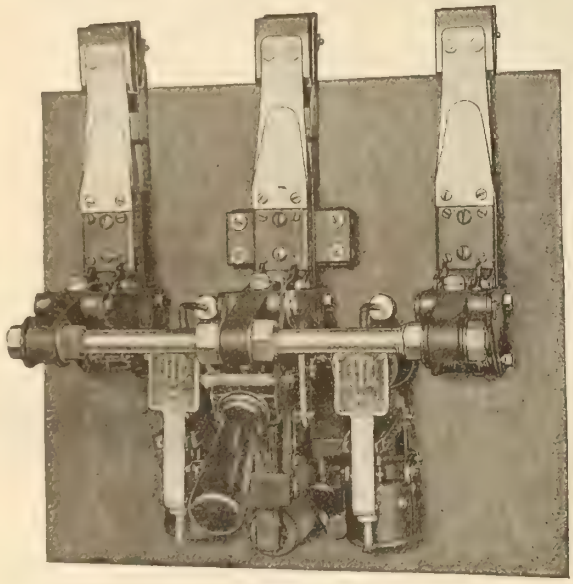
"SMITH" HYDRAULIC TURBINES

The accompanying illustration shows a horizontal shaft unit of 2000 H.P. capacity under 42' head. Write Dept. "N" for Bulletin.



S. MORGAN SMITH CO.
YORK, PA.
H. B. Van Every, 405 Power Bldg., Montreal

I-T-E CIRCUIT BREAKERS



TYPE W

Non closable on overload. Direct acting, time limit and "No Voltage."

For motor protection, especially A.C., 440 volts or less, the

I-T-E CIRCUIT BREAKER

has advantages not possessed by any other piece of apparatus. This is why one concern recently ordered over two hundred of them.

THE CUTTER COMPANY

Bank of Hamilton Building, Toronto
Main Office and Factory: Philadelphia, Pa.

New York, 50 Church St.
Detroit, Mich., Ford Bldg.
Indianapolis, Ind., Telephone Bldg.
Chicago, Monadnock Block.
Pittsburgh, Park Building.
Minneapolis, Metropolitan Life Bldg.

ECCLES & SMITH COMPANY
Los Angeles San Francisco Portland, Ore,

For Underground Work

BITUMINIZED FIBER CONDUIT

has properties not possessed by any other type of Conduit made, which recommends it particularly for Underground Systems of Distribution.

EASY TO HANDLE LOW FIRST COST
EASY TO INSTALL LOW INSTALLATION COST

7 foot Lengths ⅜ inch Walls ⅝ inch Socket Joints
Absorption, 100 Hours, less than 1 per cent. Puncture Test 50,000 Volts

Electrolysis-proof — Water-proof — Gas-proof

Write for literature

American Conduit Company

East Chicago, Ind., U.S.A. 140 Nassau St., New York City



Installing a Trunk Line Subway

Reaching Your Customers

THE logical place and time to talk to your customers is in the Electrical News when they are thinking of things electrical.

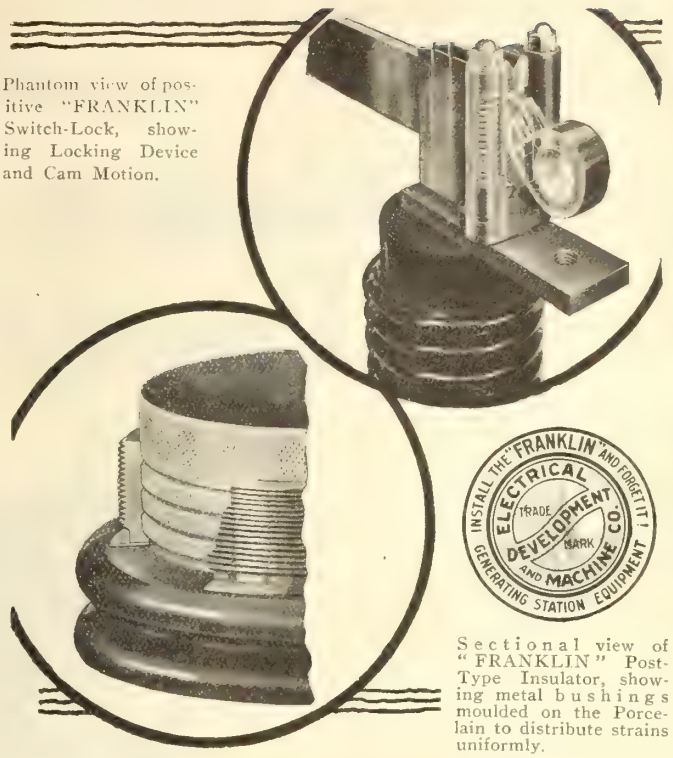
If your product is bought by electrical men, advertising in the Electrical News will carry your message to them.

You and your wares may be favorably and nationally known to-day but if you don't advertise you will soon be forgotten.

Electrical News

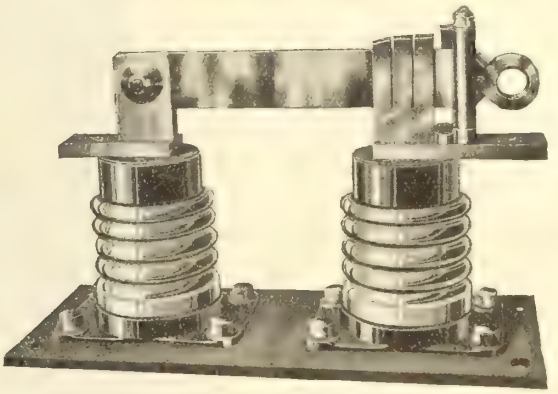
347 Adelaide Street West

Toronto



Phantom view of positive "FRANKLIN" Switch-Lock, showing Locking Device and Cam Motion.

Sectional view of "FRANKLIN" Post-Type Insulator, showing metal bushings moulded on the Porcelain to distribute strains uniformly.



When the blade slips in, this switch is **locked**—locked to **stay** locked until you **want** it open.

The greater the expulsion strain, the tighter the jaws of a "FRANKLIN" Lock will grip. Yet a single easy pull from any angle, with any kind of hook, will release the blade and open the switch.

The "FRANKLIN" Disconnecting Switch is described fully in Bulletin No. 1250. When you write, state service and voltage.

SELLING AGENTS

THE PHILADELPHIA ELECTRIC COMPANY SUPPLY DEP'T.

132 South Eleventh Street

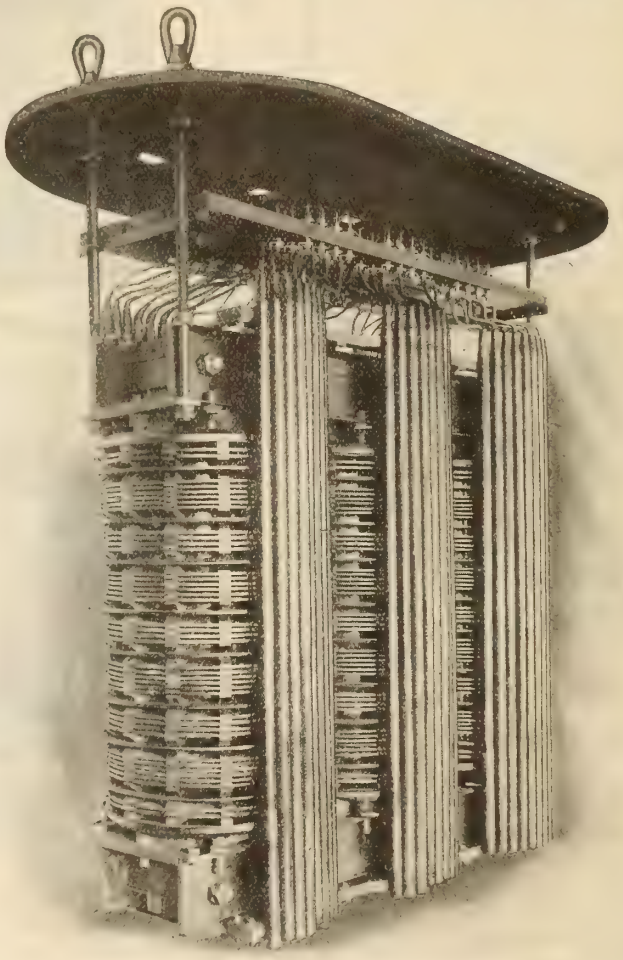
Philadelphia

"FRANKLIN"

Disconnecting Switches—Insulators—Potheads—etc.

CANADIAN
Crocker-Wheeler
Transformers

We believe in SERVICE and build it into our appliances



Core and Coils of 1,500 K.V.A., 45,700/26,400/13,200 volts to 4,000/2,300/575 volts
3 phase, 25 cycles, water cooled transformer

D.C. and A.C. motors for all services. Generators Transformers

Note the large surface windings in contact with oil which means high insulation and efficient cooling. Note method of bracing coils to prevent distortion under severe overload or short circuit conditions.

Let us send you our latest Bulletin

THE CANADIAN
CROCKER-WHEELER CO.
LIMITED

Manufacturers and Electrical Engineers

Head Office and Works
ST. CATHARINES, ONT.

District Offices
MONTREAL TORONTO

G. M. Gest, Limited

Contracting Conduit Engineers

Head Office
Power Building
Montreal

Vancouver **Winnipeg**

FERRANTI



Pole Type Transformers

Single and Three Phase

HIGH EFFICIENCY—
LOW CORE and COPPER LOSSES

Write us for Prices and Delivery before ordering elsewhere.

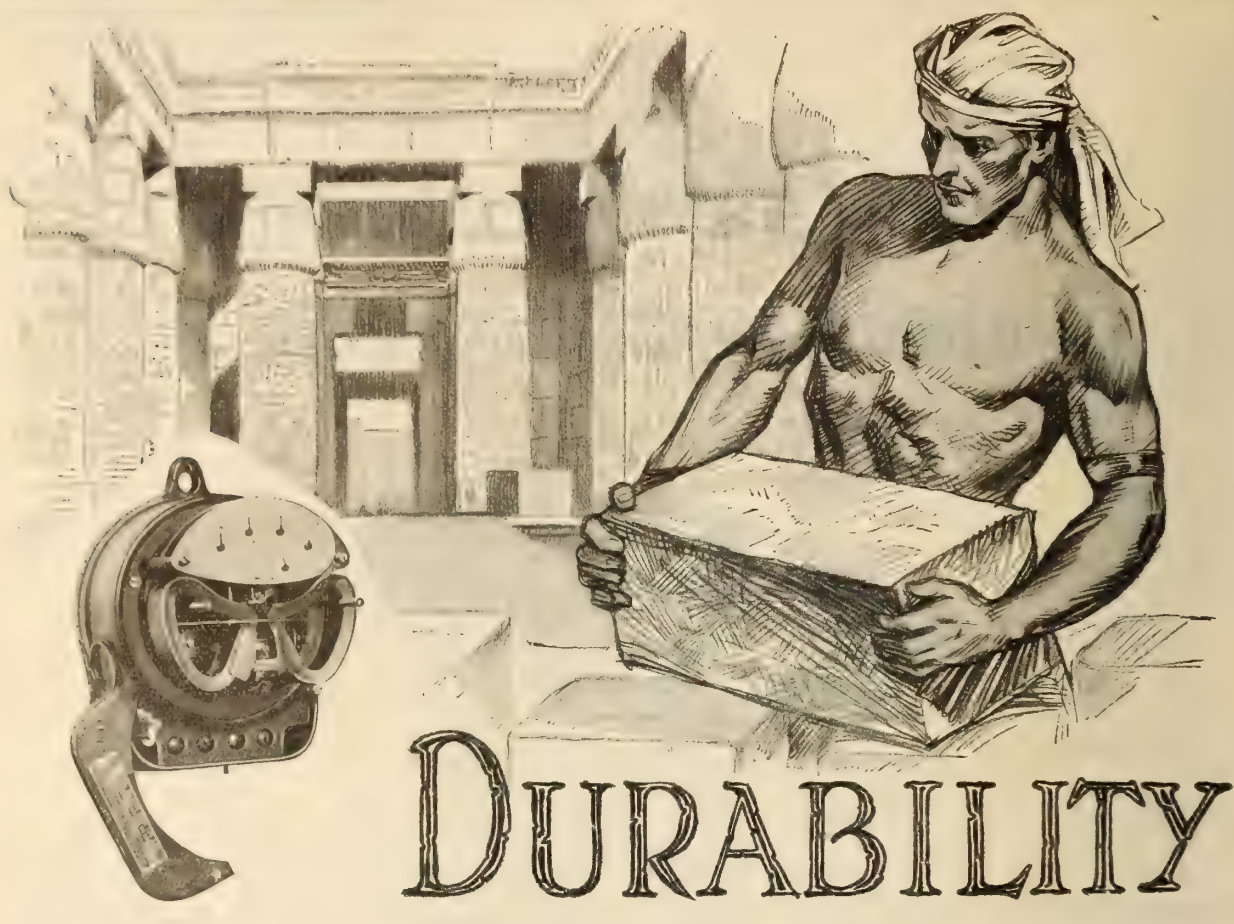
House Service and Power Meters, Ammeters, Voltmeters, Current and Potential Transformers supplied from stock.

Ferranti Electrical Company of Canada, Limited

90 Sherbourne St. TORONTO | 704 Unity Bldg. MONTREAL | 592 Notre Dame WINNIPEG

FERRANTI

FERRANTI



DURABILITY

Type I-14 Watthour Meter

The Egyptians built for permanence. They put the best of their aptitude and facilities into every unit of their structure. Durability was their keynote and we admire them because their works show they lived up to it.

Where centuries ago they dedicated huge monoliths to the gods, the manufacturer of meters **today** dedicates his products to critical humans. Only by the satisfactory operation of these small mechanisms can his work be called a success.

The I-14 Meter is built by men long trained in that work and with facilities developed for that need. The materials used in their construction, too, are the best that can be obtained or manufactured. From back plate to cover the individual parts are built to last and give long service.

The extensive use of this one type of watthour meter by many firms, after submitting the meter to trying conditions, proves that our modern meter builders have imitated the ancients by retaining "Durability" as their watchword.

CANADIAN GENERAL ELECTRIC CO.
LIMITED

Head Office: Toronto. Sales Offices: Montreal, Quebec, Halifax, Sydney, Ottawa, Cobalt, South Porcupine, London, Winnipeg, Calgary, Edmonton, Nelson and Vancouver.



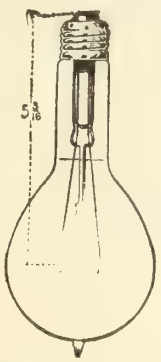
Reduction In Prices

on all large style

Sunbeam and Edison MAZDA LAMPS

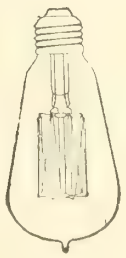
EFFECTIVE NOW

MAZDA—the most efficient Tungsten Lamp made.



They retain their initial Candle Power during their whole life.





All Mazda Tungsten Lamps of our manufacture are guaranteed to give an average life of not less than 1000 hours, in accordance with Standard Specifications issued by U.S. Government (Bureau of Standards.)

LONGER LIFE means POOR EFFICIENCY.

Why not write us to-day for our proposition covering your year's requirements?

Our prices will interest you.

CANADIAN GENERAL ELECTRIC CO.

LIMITED

Head Office: Toronto. Sales Offices: Montreal, Quebec, Halifax, Sydney, Ottawa, Cobalt, South Porcupine, London, Winnipeg, Calgary, Edmonton, Nelson and Vancouver.


HAMILTON PIG IRON
OPEN HEARTH STEEL BILLETS
STEEL AND IRON BARS
RAILWAY FASTENINGS-FORGINGS.
BOLTS NUTS AND WASHERS.
POLE LINE HARDWARE.
SCREWS-WROUGHT PIPE-
WIRE-AND WIRE PRODUCTS of
EVERY DESCRIPTION.
Service
Quality
THE
STEEL COMPANY
OF
CANADA
LIMITED
HAMILTON - MONTREAL



Where Motor Reliability is Shown at its Best

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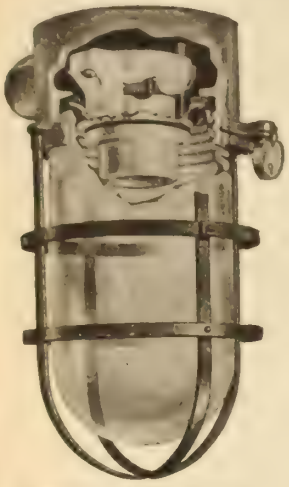
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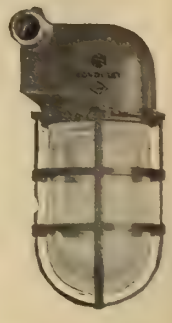






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Buy Useful Gifts—Buy Now

After conference with representatives of leading industries and retail interests concerned, the U. S. Council of National Defense reports that the manufacture of goods for the coming holiday season has been substantially completed, that the transportation of the goods to the point of sale is also largely done and urge that Christmas shopping begin at once and be spread evenly over the next three months.

The retail interests represented at the conference have agreed not to increase their working force by reason of the holiday business over the average force employed by them throughout the year, and not to increase the normal working hours of their force during the Christmas season. They also agreed to use their utmost efforts to confine Christmas giving, except for young children, to useful articles and to spread the period for holiday purchases over the months of October, November and December.

The retail interests referred to have further agreed to make announcement to the above effect in their advertisements commencing immediately. The above suggestions if faithfully and loyally put into effect throughout the country will make possible a continuance of the holiday custom without endangering the national interests thereby.

The Council of National Defense will co-operate in carrying out the suggested measures. It looks to organized business bodies of every nature and throughout the country actively to join in the movement as providing means whereby that co-operation between the government and the people can be had which alone will permit continuances of holiday business by such methods as are consistent with the national welfare.

If this idea is good for the United States would it not be equally so for Canada? In the interests of conservation of salespeople, to say nothing of the nervous energy of the public itself, let us make our slogan "Buy useful gifts—buy now."

St. Lawrence Power Co. Secure Privileges with Time Limit

The International Joint Waterways Commission has assumed authority in the matter of the application of the St. Lawrence Power Co., and have granted this company permission to build their weir. The proviso is attached that it must be removed at the end of five years, or if the war should last longer, at the ending of the war.

In granting this permission the joint commission is evidently accepting in good faith the statement of the company that the extension is only required to meet war demands. The proviso attached is merely an evident intention to guard the rights of both countries in the St. Lawrence River. The placing of the time limit, though quite too long, if the war should end as soon as we all hope, leaves the final disposition of the St. Lawrence water powers entirely at the disposal of the governments. The gravest objection to the decision is probably found in the fact that when the St. Lawrence Power Company makes its claim four years hence, as they naturally will do the onus of proof that the weir is adversely affecting the flow of the river rests with Canada. In all fairness the responsibility of proving their point should have devolved on the company that has received the benefit of the doubt during the four year period. The commission's decision reads as follows:

The Order as Granted.

"It is hereby ordered as an interim measure that the construction of the said weir and its maintenance until the expiration of the term of five years from the date hereof, or until the termination of the present war, is hereby approved upon the following conditions:

(1) "That at the expiration of said period of five years, or upon the termination of the present war, whichever shall last occur, said weir shall be removed by the applicant, reserving, however, to the applicant or any other interested party the right to apply to the commission at least one year before the expiration of the said period for a further continuance of the said weir, and on such application the commission may approve of such continuance on such terms and conditions as it may deem appropriate and equitable for the protection of the rights and interests of the people on both sides of the line.

(2) "That the said weir shall be constructed and maintained in accordance with the plans mentioned, and under all the terms and conditions set forth in the permit granted by the Secretary of War dated Sept. 10th, 1917, so far as the same are applicable.

(3) "That for the purupose of protecting the rights, property and interests on either side of the boundary from any injurious effect, resulting from the construction and maintenance of said weir, the commission will, during the term of its approval, herein retain jurisdiction over the subject matter of said application, and may make such further order or orders in the premises as may be necessary.

"Provided that in the foregoing order the commission shall not be deemed to have considered nor passed upon any question pertaining to the rights of the applicant to divert water from the St. Lawrence River."

The expected has happened in the announcement that the Canadian government refuses to acknowledge the right of the

Joint Commission to make a judgment in the matter and will make a protest with the United States government. In the meantime it is said that the power company is going ahead with the work.

Who Sells Electrical Goods?

A trade magazine devoted to the hardware trade quotes "the sales manager of one of the largest electrical firms in the country," to the effect that, "about 78 per cent. of his output is now being handled by dealers in other lines than the regular electrical firms."

We have no means of knowing the particular line of goods referred to, but the statement, if true, is a caustic commentary on the inadequacy of the electrical dealers' organization to cover the field. Such a state of affairs indicates a woeful lack of organization—an almost entire absence of co-operation between the various elements in the electrical trade. There may well be some arguments in favor of such an arrangement, but surely there are many more against it—chief of which seems to be placing the retailing of electrical appliances in the hands of a class of men who know nothing of the virtues of these goods and whose enthusiasm (even if they did know) must at best be evenly distributed over a number of competing lines—gas, coal, wood and coal oil, to say nothing of the many other lines the average hardware man carries.

There is no apparent reason why every town large enough to support two or three hardware stores, should not also be an excellent location for a live, up-to-date contractor-dealer. It should not then be a difficult matter to come to an agreement with the various manufacturers that their products should be handled exclusively through this store. The fact that hardware stores take so readily to electrical goods shows pretty conclusively that they are readily saleable and also profitable. Should the industry as a unit not work for an exclusive electrical store in every town? Would it not in the end mean, "more electricity, used in more ways, by more people?"

Opening of the 1918-19 A. I. E. E. Season

Seventy members and friends attended the meeting at the Engineers' Club on Friday Sept. 20 which opened the 1918-1919 season of the Toronto Section of the A. I. E. E. This is the beginning of the sixteenth year since the formation of the Toronto Section but the keenness of the members has shown no decline with advancing years. Mr. P. M. Lincoln the speaker of the evening is well known in Toronto and his talk on the Development of Electric Power Transmission was full of interest in a city which receives practically all its electric power over a group of high tension lines. For this reason the discussion was particularly active and controversial. Mr. Arthur Hull who presided announced that a further aspect of controversy would be introduced at the next meeting on Oct. 4 when a discussion on the Grounded Neutral on High Tension Systems would take place. It was desired to discuss every possible phase of the subject, the number of points for grounding, value of resistence or reactance and broadly whether under any circumstances an isolated neutral had any advantage. It was also announced that in November an official meeting of the Institute would, be held in Toronto at which the president and directors would attend from New York. Among the members who took part in the discussion were the following: John Murphy; H. C. Don Carlos; F. G. Clark; E. T. J. Brandon; H. U. Hart; D. H. McDougall; H. B. Dwight; E. V. Pannell and A. E. Davison. The secretary is compiling a list of members of the Toronto section on active service and will be glad of any assistance the home members can give him.

Imperial Water Power Board

The conclusions of the special committee of engineers and scientists, recently appointed by the British Government to investigate the power resources of the Empire, that there should be created an Imperial Water Power Board, to include a representative nominated by each of the Dominions overseas, is fraught with such tremendous import to Canada that it is hoped the Government will take prompt and favourable action upon the suggestion. Our own Government has already given evidence of its appreciation of the prime importance of a thorough knowledge of our power resources and the urgent neecssity for their development so that we may be in a position to meet all the needs of the country. This is essential in order that Canada may compete, with success, in the reconstruction period following the war. By the creation of the Dominion Power Board, under the chairmanship of the Honourable Arthur Meighen, the Government has provided a means of concentrating upon this great problem, the experience and judgment of the Dominion and Provincial organizations concerned with the administration and the investigation of water powers. This Board has but recently been constituted but it has already given evidence of its usefulness and should undoubtedly produce results of lasting benefit to the country.

Opening Meeting, Electric Club of Toronto

The opening meeting of The Electric Club of Toronto, held in the Prince George on Friday, September 20, was satisfactory in every way. The large and representative attendance was indicative, no doubt, of the interest the members are determined to take in their club this year, though there is no question but that the program was very largely responsible for numbers that could scarcely have been anticipated so early in the season when many of the members have not yet returned to the city. Mr. K. J. Dunstan, the president of the Club, who was the speaker on this occasion, gave the members a rare treat in a wonderful word-picture of his trip to and from the European Continent this summer and his experiences in England and France. Mr. Dunstan spoke under the disadvantage of having to concentrate the incidents of months into the short space of half an hour, but succeeded to a degree in focusing the attention of his audience on the salient points. Through all their varied programs, the Club has heard nothing more thoroughly delightful or more intensely interesting.

One Man Cars

The St. John Railway Company have made application to the Utilities Commission for authority to operate one-man cars. The application is opposed by the men on the ground that some 28 of their number would be thrown out of employment. In view of the shortage of labor of this class in other cities their argument would almost seem to favor the use of one-man cars. However, it was further held that with the hilly nature of the city, these cars might create an increased hazard to the patrons of the system. Further evidence is being taken.

The Royal Commission appointed to deal with the affairs of the New Brunswick Power Company has issued an interim report which contains an order, effective October 1, granting a temporary increase of rates by the company. After that date car fares will be six cents instead of from four to five; electric light will be 7½ to 15 cents instead of 6 to 12, and power rates will be 2.75c to 12 cents instead of 2 to 10. The commission also recommended the introduction of one-man cars.

Electro-Technical Industry of the World During and After the War

The course of the electrical industry of the world during the war is fully treated by M. Gurewitsch in the Bulletin of the Association of Swiss Electrical Engineers and reported in the Electrical Review. Among the industries, he says which have undergone great development, not only in belligerent but in neutral countries, the electrical industry takes an important place. From the outset of the war, the electrotechnical works in Germany, France, England, and the United States were able to adapt themselves quickly to the manufacture of munitions, and to realize large profits thereby. Let us take, for example that establishment which is in the forefront of the German electrical industry, the Allgememe Electricitats Gesellschaft. According to the last annual report, electrical installations actually under construction had fallen in value from 48,000,000 to 46,600,000 marks. Notwithstanding this, the amount of business transacted was very considerable, which is explained by the extensive orders from the military authorities; the gross profit realized had allowed of the making of large extensions to the works. If a portion of these extensions was principally due to the needs connected with the manufacture of munitions, there remained no inconsiderable portion available for employment after the war, which would thus strengthen the financial position of the company. The net profits realized in 1916-17 were below those of 1912-13 by 2,470,000 marks (30,370,000 against 27,900,000 marks). Other electrical works in Germany, as well as in the other belligerent countries, achieved similar results. But the manufacture of electrical material generally had much increased, as the thousands of works supplying war requirements created an enormous demand for electrical machinery and plant. The rolling mills in America during 1916 made calls for electric motors of a total power of over 200,000 H.P. (among which were units of 6,000 and 10,000 H.P.) while from 1905 to 1916 the yearly increase in the same industry was only between 40,000 and 60,000 H.P. The following table gives (in millions of dollars) an idea of the growth of electric production in the cases of three of the chief American companies:—

	1912.	1914.	1916.
General Electric Co.	90	90	120
Western Electric Co.	73	60	105
Westinghouse Co.	37	32	80

It may be remarked in passing that the first-named company increased its capital in 1917 by $20,000,000.

In the above figures war material is not included. Furthermore, only 7 per cent. of the output was destined for exportation; all the remainder was absorbed by the home market of the States. Nevertheless, as an outcome of the stoppage of German exports (which in 1913 totalled 467,500,000 fr., against 189,000,000 fr. for England and 146,000,000 fr. for the United States) the exports of the American electrical industry considerably increased. Hence the total exports of electrotechnical products rose from $28,200,000 in 1913, $19,960,000 in 1914, and $24,340,000 in 1915, to $40,240,000 in 1916. Thus the exports of 1916 exceeded to the extent of 43 per cent. the already fine figures of 1913.

Not only the American electrotechnical industry but that of Sweden likewise showed excellent results. That country was not only able to supply its own home markets, but also furnished large quantities of electrical products for exportation, especially to Russia. The largest Swedish electrical concern, the Allmanna Svenska Elektriska Aktiebolag at Vasteras (A.S.E.A.) realized in 1916 a net profit of 12,400,000 kr., against 4,600,000 and 2,200,000 kr. in the two foregoing years. This company has increased in capital from 26,000,000 to 33,000,000 kr., and acquired a number of works—the Nya Forenade Elektriska A.B., the Evenska Turbin Fabriks A.B., the Lilijeholmens Kabelfabrik, etc. Besides this, it has set up a foundry and a porcelain insulator works. This increase of the company's export business is shown in the following table (in millions of kroner):—

	1912.	1914.	1916.
Home market	13.9	20.6	39.4
Exports	3.8	6.2	10.9

Exports for 1916 were thus threefold those of 1912. The branch companies of the A.S.E.A. in Denmark, England, and Russia also did good business. During the war the company's position was so strengthened that it no longer had any fear of foreign competition in Sweden. For example, while imports of electrical machinery from Switzerland in 1913 were 316,000 fr., and in 1914 694,000 fr., the figures in 1915 and 1916 fell to 57,000 and 101,000 fr., respectively.

The English industry was too much occupied with war supplies to pay attention to the normal market. English exports consequently fell off, as the table below shows (in thousands of pounds sterling):—

	1913.	1915.	1916.
Exports of electrical machinery	2,275	1,391	1,552
Other electrical goods	5,405	3,169	4,107
	7,680	4,560	5,659

In consequence of the enormous demands and the difficulties of manufacture, even for the home market, imports of electrotechnical products into England showed only a small reduction, namely:—

	1913.	1915.	1916.
Electrical machinery	1,345	1,522	1,088
Other electrical goods	1,587	1,096	1,653
	2,932	2,618	2,736

The most important supplier to England was the United States. Switzerland supplied machinery principally, exports rising from 1,234,000 fr. in 1913 to 2,014,000 and 1,798,000 fr. in the two following years. On the other hand, Swiss exports fell in 1916 to 642,000 fr., and in the first nine months of 1917 to 452,000 fr. It must be remarked that the manufacture of electrical machinery in England before the war was fairly well developed, machinery figuring as 30 per cent. of the total electrical exports. It must be believed therefore, that after the war electrical construction works, enlarged and strengthened by supplying the military requirements, will be in a position to satisfy all the wants of the Empire. The manufacture of electrical machinery has, indeed, attained such a development in England that the Government, on November 16th, 1917, forbade imports as unnecessary. (Besides, Swiss industry in the matter of machinery, can hardly struggle against that of England, as the former is 10 per cent, dearer.)

On the other hand, Swiss exports of measuring appliances to England greatly increased during the first three years

of the war, as the figures below show (in thousands of marks):—

	1913	1914	1915	1916.	Jan.–Sept. 1917.
Control and measuring appliances	181	332	387	402	89
Various	118	307	473	297	176
	299	639	860	699	265

The prospects of the exportation of installation material into England should, in general be favorable, for English manufacture of this material was very little developed before the war, insomuch that Germany exported to England in 1913 goods of this kind to the value of 9,752,000 marks. In reality, however, English works at the present moment are in a position to meet home wants, and to such a degree that the Government has, for example, forbidden the importation of meters.

France had greatly reduced its imports of electrotechnical products; these had fallen from 37,500,000 fr. in 1913 to 24,100,000 fr. in 1914, and to 24,400,000 fr. in 1915. But as since then the military calls for electrochemical and electrometallurgical products have enormously increased, a very intense constructive movement in the domain of hydraulics has begun. In consequence, French imports of electrical plant in 1916 rose to a value of 61,300,000 fr., sub-divided as follows:—

	Fr.
Electrical machines	15,100,000
Apparatus and measuring instruments	15,400,000
Cable and leads	14,000,000
Armatures and machine parts	7,500,000
Various apparatus	9,300,000

French exports fell from 37,200,000 fr. in 1913 to 28,000,000 fr. and 26,300,000 fr. in the two following years; on the other hand, they rose in 1916 to 46,300,000 fr. This rise is chiefly explained by the large exports of electrodes, which varied as follows:—

	Fr.
1913	8,560,000
1914	6,320,000
1915	12,090,000
1916	25,760,000

From the point of view of quantity the export of electrodes in 1916 was only 10 per cent. more than in 1913, but the value was trebled. In the case of Switzerland, French exports of electrodes sank to a third in the same period: 765,000 fr. in 1913 and 244,000 fr. in 1916. We said previously that France imported electrical machines to the extent of 15,100,000 fr. A little less than half of these imports came from Switzerland, which exported machines to France in 1916 to the value of 6,900,000 fr. (30 per cent. of the total exports). In 1917 (January to September) exports to France reached the figure of 4,800,000 fr., whereas for the whole of 1913 the figures were only 4,170,000 fr. The considerable augmentation in the figures of Swiss exports of electrical machines to France is not explained merely by the increase in the price, but also by the larger quantity—namely, 16,432 machines in 1913, against 22,822 in 1916. In 1914 and 1915 exports fell to 3,000,000 and 3,500,000 fr. respectively. Swiss exports to France of "sundry apparatus" likewise increased after suffering a decline in 1914 and 1915. Thus the total rose from 1,461,000 fr. in 1913 to 1,975,000 fr. in 1916, and to 1,666,000 fr. in 1917 (January to September only). In the same period exports of Swiss glow lamps to France rose from 323,000 fr. to 1,269,000 fr., and in 1917 to 712,000 fr. for the first nine months only. Exports of batteries from Switzerland likewise advanced from 33,000 fr. in 1913 to 664,000 fr. in 1916; while, on the other hand, control apparatus and measuring instruments suffered a fall from 634,000 fr. to 348,000 fr. As a matter of fact, the manufacture of measuring apparatus is highly developed in France—to such a pitch that in 1913 that country was able to export these articles to the value of 14,600,000 fr. In 1914 and 1915 these exports fell to 9,100,000 fr. and 6,800,000 fr. respectively, rising, however, in 1916 to 12,100,000 fr.

The author believes that in the future France will be compelled to import electrotechnical goods, particularly when it is remembered that, according to American estimates, an expenditure of 500,000,000 fr. on these articles will be needed in the work of reconstitution of the invaded provinces. According to the statistics of the president of the Syndicat des Industries Electriques, the yearly output in France of electrical goods before the war reached the total of 221,000,000 fr., which amount is subdivided as under:—

	Fr.
Dynamos, transformers, and electric cranes	66,000,000
Electric apparatus and lamps	67,000,000
Cables and leads	40,000,000
Telegraph and telephone apparatus	26,000,000
Sundry appliances	22,000,000

According to other estimates, the French output would be 300,000,000 fr. (against an output of 1,550,000 fr. in Germany in 1913, and 1,900,000 fr. in America in 1914), of which 100,000,000 fr. stand for electric machines and transformers, and 60,000,000 fr. for cables and leads. In any case, the French industry cannot suffice for itself. As regards Switzerland more particularly, the situation will be very favorable in view of the difficulty which Germany will meet with in the resumption of trade, her exports to France totalling, before the war, 18,000,000 fr. Switzerland will, however, have to reckon seriously with English and American competition.

Italy is unable, any more than France, to supply her growing requirements of electrotechnical products, and the more so, because her industry is less developed. Even in pre-war days she was obliged to have recourse to foreign industries (particularly those of Germany); in 1913, for example, Italy imported to the extent of 32,000,000 lire. Italian exports were unimportant and only amounted to 10,300,000 lire. Three-fourths of the exports were made up of cables shipped, for the most part to South America. After the entry of Italy into the war, Switzerland occupied the position of Germany as the supplier of Italy. Swiss exports to Italy were as under (in thousands of francs):—

	1913.	1914.	1915.	1916.	(Jan.–Sept.) 1917.
Electric machines	934	1,158	1,089	873	677
Control apparatus and measuring instruments	355	276	373	959	949
Telegraph and teelphone apparatus	14	17	84	1,055	603
Glow lamps	276	252	1,420	2,689	3,113
Sundry appliances	489	507	245	579	395
	2,060	2,219	3,211	6,055	5,737

As in all other belligerent countries, electrotechnical works in Russia have done good business, and dividends have been much greater than in peace times. Almost all the works have doubled their capital. The Russo-German A.E.G. Co., whose dividend for 1916 was 10 per cent., has been reconstituted, after its liquidation on July 1st, 1917, under the style of the General Electric Co. (A.E.K.), with a capital of 24 million roubles, one third of whose shares have been acquired by the Russian Government. According to the latest reports, this company (in which the American General Electric Co. has interest to the extent of 4,000,000 rubles) has raised its capital to 36,000,000 roubles. The Russian Siemens-Schuckert Works and the A. G. Siemens & Halske (whose dividends in 1916 were 7.5 and 12.5 per cent. respectively) have likewise

been liquidated, and towards the end of 1917 were to be transformed into a new Siemens company with a capital of 25,000,000 roubles, in which the Russian State would take a share.

The third Russian electric company—the Dynamo—in which the English and American Westinghouse companies take a considerable share, doubled its capital in 1917, raising it from 10,000,000 to 20,000,000 roubles. Similarly the Basins of the Donetz Electricity Co., founded in 1916, proposed to build extensive electricity works near the Donetz coal fields, and by utilizing the anthracite deposits there furnish Southern Russia with cheap electricity. The company has secured authority to raise its capital from 7 to 14 million roubles. Other new companies are:—The Donetz Electric Power Co., 5,000,000 roubles; Electrification of Grosny-Naphtha District Co., 4,000,000 roubles; and South Russia Electric Installations Co., 30,000,0000 roubles. The two related companies—the Petrograd Electric Lighting Co. and the Baku Electric Power Co.—have also increased their capital from 9 to 13 million roubles. Its internal disorganization has hindered Russia from undertaking the utilization of its many waterfalls, although in 1917, 32,000,000 roubles were allocated to deal with the fall on the River Walchow. As an outcome of the coal deadlock, many new electric railway schemes have been planned, such as the Crimea railway, that of Trans-Caucasia, and the Kars line. All these schemes are hung up owing to the internal state of Russia.

Japan electrical industry has undergone an enormous expansion during the war. So recently as 1913, Japan was obliged, on account of the undeveloped state of her own industry to draw upon oversea countries, principally Germany and England. German exports of merchandise to Japan in 1913 were to the extent of 15,000,000 marks; electric machines, about 45,000,000; cables, 3,000,000; high-tension apparatus, 1,700,000; measuring instruments, 660,000 marks, etc. England exported to Japan in the same year to the value of £286,000 (electrical machines, £188,000). Japan's total imports in 1912 reached 35,000,000 yen, 50 per cent. from Germany and 30 per cent. from England.

Since the war the position has completely changed, and Japan's electrical industry has not only been able to supply its own home wants, but also to intervene in the markets of the world. Before the war, that country's output of electrical machines was between 30,000,000 and 35,000,000 yen; in 1916 a value of 85,000,000 yen. This brilliant showing is owing, first, to huge war exports; and, in the second place, and chiefly, to her possession of ample copper resources available at small cost. This advantage which the Japanese industry enjoys over that of the European industry will subsist aftetr the conclusion of peace, for, on account of the dearth of tonnage, European countries, and especially Germany, will be able to import copper only with the utmost difficulty. Thus in the Far East the European electrical industry can hardly hope to compete with that of Japan.

The Swiss electrical industry has suffered much from the war; this is especially so as regards the wholesale industry. The manufacture of electrical products has had to struggle against enormous difficulties—such as the want of raw materials and labor, and the difficulties of transport. These last have completely paralysed exportation to certain countries, notably to Russia. The influence of the war on Swiss exports of electrotechnical products is clearly shown by the following table:—

Swiss Exports in Thousands of Francs.

	1913.	1914	1915.	1916.	(Jan.-Sept.) 1917.
Electrical machines ..	20,353	15,578	15,245	22,631	16,618
Control apparatus and measuring instruments	2,307	2,037	2,904	4,304	2,6..
Glow lamps	850	577	2,369	4,691	4,465
Accumulators	115	85	818	1,131	390
Telegraph and telephone apparatus	150	107	144	1,120	615
Cables and leads	1,403	974	451	510	428
Lamp carbons	143	184	562	478	151
Sundry apparatus	4,996	5,740	2,960	5,878	5,033
	30,357	23,283	25,454	40,742	30,307

It should be noted that if the total of exports is larger for 1916 than for 1913, the number of machines exported is less. One thing that must be said is that the retail industry has grown at the expense of the wholesale. In 1916 one-half of Switzerland's exports of accumulators and batteries went to France; likewise, the whole of the glow exports, which had practically quadrupled, went to France and Italy. Of the Central Powers, Germany held first place as recipient, more especially of electrical machines, owing to their abnormal dearth there, due to that country's inability to furnish itself with copper.

Lastily, the Dutch market has undergone considerable development since the war, as has also that of Spain. The wants of the latter country will be still larger after the war, for the growth of the Spanish industry has been very rapid.

A few words in conclusion as to the future of the electrical industry of the world. We said above that the Americans, who were much interested in the reconstitution of the invaded countries have estimated the requirements of France in the matter of electrotechnical products at 500,000,000 fr. They estimated, furthermore, those of Belgium at 250,000,000 fr. On these bases the reconstitution of all the invaded lands would demand fully 1,000,000,000 fr. Nothing short of this will be needed to occupy the electrical industry of the world for many years to come. On the other hand, the normal calls for electrical products will greatly increase after the war. The general lack of coal, which will continue long after the war, will everywhere lead to the utilization to a greater extent than formerly of water-power, etc. Furthermore, the scarcity of foodstuffs, cotton, etc., will give a new spurt to the realization of irrigation schemes in Italy, Russia, Asia, and other countries, and all such schemes imply huge hydro-electric installations. In lands lacking great water resources, small installations will have to be superseded by big generating stations erected near coal mines. Finally, the fact must not be lost sight of that the extensive electrochemical and electrometallurgical establishments which have grown up during the war will need after the war an enormous amount of electrical energy. Moreover, the call for electric power in all industries will be enlarged to an extraordinary degree after the war; for electricity tends daily to become the basis of industry in all its branches. Its more rational production, enabling energy to be supplied at a much lower rate, will raise it from the position of a mere accessory to that of the very essence of all industrial production.

Long Distance Wireless

A new high-power radio station has just been opened at Annapolis, Md., capable of maintaining uninterrupted communication over a distance of at least 4,000 miles. There are four steel towers, each 650 feet high, supporting the antennae which, with the ground system, required 160 miles of wire for their completion. The power supply installation is in duplicate so that in the event of one plant failing it will always be possible to maintain communication. The operation of the station requires the services of 100 men and suitable provision has been made for protection. The plant was erected in 10 months and cost $1,500,000.

Modern Practical Methods of Accident Prevention in Small Companies

By Mr. Wills Maclachlan*

Possibly the reason for assigning to me this subject is because I asked for a solution of it at the New York Convention. Accident prevention in the small utility or in the large utility, transmitting energy hundreds of miles with only a small operating force at any substation, is entirely different from that of a company where the calling of a meeting of one hundred or five thousand employees, is possible. In one, you are dealing with a few employees at one time in a more or less personal way, in the other you are dealing with a number and the psychology of the crowd is brought to bear. I have by no means a complete solution to offer, because I had no precedent to follow. I have been forced to use for the most part the "cut and dry" method and have had to a great extent to use my own judgment as to the particular method that would work out best in the individual case.

No matter what method is used, there is one axiom that should hang over the desk of anyone in charge of accident prevention work. —"Don't bluff". If you are in earnest and mean exactly what you say and act as if you meant it, men will follow you and you will have their support. If you are trying to put something over under the guise of accident prevention, they will see it before you have finally decided upon the details yourself. You will have done yourself and your men an injury and delayed the real work of accident prevention. Remember that you are working to save money for the company, and to safeguard the service to your consumers, as well as to preserve the limbs and lives of your men, for themselves, their wives and families and for their country and its Allies. Tell your men this and lay your cards on the table and gain their respect and support.

One of the difficulties of interest to the small company in accident prevention is the fact that accidents do not occur frequently in the same plant. This is quite true, but accidents or lost time per capita in the small plant is as large, if not larger, than in the large plant and the hazard is just as great. Also in utility work the accidents are not numerous but they are severe. I think that I am safe in saying, that if the manager of the small plant will sit down and make out a list of accidents and lost time, due to accidents, over a period of a few years, he will fully realize his duty as far as the work of preventing accidents is concerned, just as much as will the manager of a concern employing thousands. His is the legal responsibility of financial economy to the company, his also is the moral responsibility to his men and their families.

Must Be Handled by An Expert

To successfully handle any work in a company, it must be put in the hands of someone who is an expert in the particular line. In the large company, accident prevention is the whole duty of one man or a staff. This is not possible in the small company, but there is nothing to prevent a number of small companies banding themselves together into an association for the purpose of accident prevention and employing someone to supervise the work for them. This has been done successfully and to the advantage of all concerned, the companies gaining the benefits of the wider experience of the supervisor than if he were engaged by but one company.

Another plan that has worked out very successfully is to engage on retainer a supervisor who will give a certain portion of his time towards the work of the company. This supervisor may be one man or may be a firm or bureau.

In regard to the carrying on of accident prevention in a public utility, I feel that it should be in the hands of an engineer who has had experience in design, construction, operation and management. I realize that this is usually a large order, but you are playing for the lives of men. I fully realize that many in this work are not engineers, but you will usually find that they have the advice of engineers, and if you can combine the qualities in one man, I feel that you are in a stronger position. I also lay emphasis on the experience; this, I feel, is important. He will have to work with all departments and must be in a position to deal intelligently with their details. When you meet the line foreman—know the right way to put on his belt and spurs and know the details of line work and you have him with you.

In starting the work in a utility, I would say the first thing to do is to go over the accident record for as many years as is possible and tabulate this under "Cause and Department" for accidents and lost time due to accidents getting it on a per capita basis if possible.

Next comes the physical examination of the plant. Let us assume a hydraulic development under moderate head with a transmission line and substations. The intake should receive our first consideration. Is the dam safe? Should it be guarded to protect employees or the public? Is the stop-log winch O.K. or should the gears be protected and should men be warned in regard to danger from winch handle if the chain is down during moving of winch? Then the racks need attention. A very good plan is to put a 4 x 6 along the edge of the platform just over the racks. This gives the men a good foothold in icy weather. If men are working over fast-moving water, they should have life lines, and at least life buoys and pike poles should be handy.

Protection in the Power House

Next let us go into the power house, taking up first the turbine equipment. The belts driving the governors and oil pump, if any, should be guarded by a wire mesh guard. The fly balls and small gears on governor should also be guarded. Then if the turbines are driven by crown gears these should be enclosed. Safe access to all bearings should be assured. Guard rails should be put around the generators and any exposed leads guarded. I mean here, guarded and not insulated. Next the switching equipment. Are there disconnecting switches between the oil switches and the busbars and between the oil switches and outgoing feeders? This is important for maintenance work. Can all fuses on motor transformers be easily got at? Switches should be plainly and distinctly named, preferably front and back of the board. Rows of disconnecting switches should have distinguishing mark between different switches and the name of the switch in such a position that when the operator reaches with his switch stick for the switch, he will see the name. If disconnecting switches are at all cramped, baffles of asbestos board or equivalent should be between blades. In the lightning arrestors, there should be disconnecting switches between them and line, and barriers between different banks of arrestors. If the tanks are not grounded, they should be

* Before Congress of National Safety Council, St. Louis.

screened and screen grounded. One rather important point is to guard the operator in throwing a disconnecting switch, from stepping back into live apparatus.

An important point in design but rather hard to put in force in a finished plant is to arrange two means of exit from behind all switchboards, switch galleries and from all switch cell structures. This is to give the operator a chance in case of a short circuit.

The next point is the miscellaneous equipment. All belts and gears should be substantially guarded, the stairway should be safe and passageways all lighted. Tools should be examined and all burred sledges, drills, etc., dressed. Rubber gloves should then be examined inside and out and usually condemned. Our practice is to use buckskin covers over rubber gloves. This is for mechanical protection.

In telephone arrangements in systems using high tention the operators and patrol man must be protected. This can be very well taken care of by use of the insulated stool or cabinet. Also by training operators in the correct way to use the receiver to guard against deafness from severe noise.

In arranging the lighting attention should be paid to the safe renewal of lamps and fuses. Many designers seem to forget this and place lamps and fuses dangerously near high tention apparatus.

The Transmission Line.

We will now go over the transmission lines with the patrolmen. Is there a provision for grounding the line just outside the power house? This should either take the form of grounding switches, grounding clamp or a ground chain. The patrolmen should carry either two sets of grounding clamps or two ground chains. Personally I have grave doubts as to the effectiveness of ground chains, but on some systems of patrol grounding clamps are too heavy to carry. Now, let us look at the switching tower. If it is supplied with a platform, the platform should be railed and a toe-board provided. Some systems are now putting in switching towers with switches operated by a chain or rod mechanism; this should be grounded and provision made for locking in both the open and closed positions, both of which should be clearly designated. The switch of course having its name or number clearly shown.

Coming now to the substation, we will check up the grounding provision, disconnecting switches, etc., as in the power house. It might also be well to try to get into the substation without using the key to make certain that all windows, doors, etc., are locked. If the substation has an attendant and if in the summer season, doors have to be left open for ventilating purposes, they should be supplied with wire doors that are locked. One hazard in substations that is often overlooked, is the necessity of using a step-ladder to read transformer temperatures. One way of eliminating this hazard is to make up a periscope by the use of two good mirrors and a length of fibre conduit.

In substations having no regular attendant more care should be paid to protection of apparatus than in attended stations. This is because an unskilled person is often required to go into these stations at intervals to change motor paper or to do simple switching.

In the foregoing, I have just touched the high spots of physical examination of the plant. If it is a steam plant, the same general scheme can be carried out, particular attention being paid to tools in the boiler room. Another point that should be noticed could well be called "good housekeeping". A clean, well organized plant usually makes for the elimination of accidents.

First Aid Outfits.

Every utility no matter of what size should be well equipped with simple first aid outfits. For the utility in a position to call a doctor within a reasonable time, such first aid kit should be very simple; it might contain boracic acid tablets, ginger tablets, carron oil aromatic spirits of ammonia, iodine (Either in the bottle or preferably in ampoul form) castor oil for the eye, some gauze bandages, some triangular bandages, plain or boracic gauze and absorbent cotton. For cleanliness the packages should be small in size or arranged that a small quantity can be removed without soiling the rest. This outfit should be in a compact case and should be regularly inspected. Very simple instruction as to how to use each part of the outfit should be prepared, also instruction as to how to handle a cut, bruise, hemmorhage, or the more usual injuries. This set of instructions should also contain in a very brief way the more important points of resuscitation. If these instructions are prepared in inexpensive form a copy should be given to every employee and a copy kept in the first aid kit. In general as far as first aid is concerned, make the kit simple and have the instructions as simple as possible so as not to confuse the average employee and not to give the men an idea that he is an amateur doctor. My own instructions have always been, that the best kind of first aid is given by a competent doctor and any time wasted in putting on fancy bandages is almost criminal.

Reference was made above to the question of rubber gloves. Arrangements should be made for the regular inspection and testing of rubber gloves. I do not want to take up your time here with the details, but they may be found in the report of the Accident Prevention Committee of the N. E. L. A. Provision also should be made for the inspection and maintenance of linemen's belts and spurs. I do not think that any harm would come of making a regular practice of monthly warning linemen to use their safety belts. Most of us know of cases where a lineman has received a slight shock which has been enough to unsteady him on the pole and in falling he has broken his neck. Committees are working on the correct design of linemen's belt and it is hoped that a recommendation will soon be made public. I am recommending to linemen at the present time that they shall not use hand-axes; they claim however, that it is difficult to get a hammer of sufficient weight to do the work correctly. This however, I feel is a detail that can easily be worked out. The danger of a falling hand-axe should be done away with if at all possible.

Keep Tools Properly Dressed.

The question of inspection of and dressing of sledges, drilling bars, etc., was touched upon briefly before. This is extremely important as a burr from a sledge or drilling bar is very liable to cause the loss of an eye. A regular day should be appointed for going over these two. While on this subject it is naturally suggested that the use of goggles be enforced. Their use has, on countless occasions, saved an eye and they should be supplied and their use enforced as rigorously as possible. It is also desirable to supply goggles that will protect the eyes from an electric flash. These should be non-inflammable and non-conducting and should be as clear as is possible to have them with due regard to being opaque to ultra-violet rays. This can be done without using the dense glasses used in electric welding. Men should be obliged to wear these glasses in doing any work that might occasion a bad flash, such as changing of fuses, working close to a commutator or pulling a disconnecting switch with a short stick.

Fire fighting apparatus should be supplied and rigorously inspected. Fire pails should be protected from being used as spitoons. I have found a very desirable method of doing this by pasting manilla paper over the tops of the fire pails. In using tetre-chloride fire extinguishers, men should be warned against the danger of chlorine gas in confined places.

As far as the physical plant is concerned, ample provision

should be made to allow sufficient space to operate the plant safely, tools and other pieces of apparatus should be regularly and systematically inspected and repaired when necessary. If these two general points are carried out a great number of our accidents will be prevented.

Having now covered the physical plant, our most important consideration should be the obtaining the interest of and training of the employees. First and foremost in any public utility, is the training of every employee in the prone pressure method of resuscitation. This can well be carried out as follows:

Resuscitation Instruction

A few of the employees can be got together and with one as a patient a demonstration of the method given explaining each point in detail. The men to whom this has been demonstrated should then be paired off and told to try to carry out the resuscitation that has been shown them. Most of them will have their hands in the wrong place and will carry out the resuscitation too quickly. They should then be required to practice resuscitation weekly for about two months and then once every two weeks as a part of their regular duties. Records of these practices, together with the names of the men, should be kept with the regular records of the company. After the men have been practicing for sometime, they should be taught to take their hands off the patient's back when they swing back on their knees. A good plan also is to have one man fall as if he had received a shock and curl into any position he wants to, the operator should then see how fast he can get him into position and give him the first stroke. This should be done easily in 8 seconds or less. I have trained some hundreds of employees in this way and they have resuscitated men receiving shocks up to 60,000 volts.

Even in small company, it is quite possible to have meetings of the men. These can be informal talks and if a blackboard is provided a great deal of good information can be given to the employees if the manager or superintendent will enter into the work. As a basis of these talks or meetings, some correspondence course as provided by the N. E. L. A. or various correspondence schools is useful, but a frank discussion of the various features of the plant together with new ideas that are coming out in the technical press from time to time, will be of considerable interest to the employee. In along with this talk on general matters, instruction in and discussion of accident prevention measures can well be taken up. Another important point that should be discussed is the grounding of and taking grounds off the line or apparatus. The putting a piece of apparatus or line into service or taking it out of service and the routine of changing shift. If the company has operating rules, these can well be discussed as it is my experience that in a number of cases operating rules are not understood by the employees and are therefore not lived up to. If there are no operating rules, the National Electrical Safety Code, Part IV. of the Bureau of Standards could be taken up and discussed. Where informal meetings of this type are held regularly it has been my experience that the men will show far more interest in their work, develop into more skilled workers, and be more receptive to information along accident prevention lines. At these meetings, the men should be encouraged to put forward suggestions for the prevention of accidents and if found at all good the company should put them into effect, showing that they are heart and soul with the men in their attempt to prevent accidents.

Bulletins as prepared by the National Safety Council and by other organizations can be used judiciously. Those pertaining to the work of the public utilities being very acceptable to the men and creating considerable interest. These should be shown on a regular bulletin board and not too many put up at one time. The bulletin board should have a glass front as some budding artist among the employees might make very disastrous additions to the bulletin.

To get the support of men in accident prevention work, it has been my experience that it is useless to go ahead until you have the whole-hearted support of the foremen and others in charge of the work. I would far rather take months to win the support of a foreman than to try to carry out accident prevention work with his men without his support. There is another type of man that should be won over, that is, the old employee who thinks that this work is a lot of bosh. In some instances I have taken almost unlimited time to try to find out what was the basis of his trouble and to correct that if possible. An ample stock of stories of accidents with the resulting pain and suffering to the man and his family often is very useful in winning over this type of man. These stories should be told to the man personally in a private conversation and it is just as well not to argue with him before a number of his fellow-workmen.

This plan of work for the small plant can easily be extended to the larger plant and I have found it very satisfactory to use committees a plant having about 600 employees. These committees meet monthly and are started off with the foremen; they receive the suggestions of their fellow-employees, discuss them and pass them on to the executive heads for action. In this particular case there has been a reduction this year as against last year of 41 per cent. of the lost time due to accidents.

Let me make an appeal to the small plant owner and to the larger company having men spread over a wide territory to take up this matter of accident prevention in a serious and earnest way. Your country and mine are engaged in a prosecution of a desperate world struggle. We need every man possible at the Front and this naturally depletes those who operate in our power plants to supply the necessary energy for the manufacture of munitions of war and their transportation. Every day lost by a skilled employee delays or at least interferes with the successful prosecution of the war. It is your duty and mine to see that the operating force carry out their work in an efficient manner. This cannot be done when they are surrouided by unguarded serious hazards. It cannot be done as long as they do not realize the best and safest way for the prosecution of their work and it cannot be done until you, your superintendents and foremen will earnestly throw your skilled experience and executive ability into the work of preventing accidents, and training your men. This is not something that would be nice to do if we had time to carry it out, it is not something that need only be looked upon from the sentimental side, it is something that is causing you great needless expense, interfering with the successful and continuous operation of your plant, causing pain and suffering to your employees and their families and interfering with the work of your country and her Allies.

What Delayed the Cars

Knots of people standing on street corners on Thursday afternoon, September 5, about 6 o'clock, were saying to each other, "Where are all the cars?" About that time between 30 and 40 cars were tied up on Granville street bridge, stretching back as far as Davie street on the north, because the draw span was open for 10 minutes from 5.40 to 5.50.

The passengers in the cars must have numbered 1,500; those in the scores of automobiles tied up and the pedestrians must have added 500 more. So 2,000 were directly delayed 10 minutes by the opening of the bridge. Several thousands more were inconvenienced by the cars being thrown off schedule during the next hour.

What was the great vessel which so urgently needed passage through the bridge in the busiest hour of the day? A pile-driver!—B. C. Buzzer.

Economic Proportion of Hydro-Electric and Steam Power

By Mr. Frank G. Baum

It is, of course, well known that steam power is usually less expensive for low load factors than hydroelectric power, and the latter becomes economical only when the load factor is favorable. To determine the economical division between the two there are usually given curves of cost varying with load factor. Such curves show that at certain load factors the cost of steam power exceeds the cost of water power, but the actual yearly cost of power for any assumed proportion between water power and steam power must be calculated for each case. This becomes laborious.

The results can, however, be shown in a much more illuminating way if presented as shown in Fig. 1. In this figure, abscissae from left to right (from O to O_1) show percentage of total load carried by water power and from right to left (from Oo to o) the absicissae show the percentage of total load carried by steam power. The sum of the steam power and water power must of course equal 100 per cent. for every condition, hence the sum of the two abscissae is 100 per cent. at any point.

If now we take the yearly cost per kilowatt of hydroelectric power as O_1h, taken in the figure at $22 per kilowatt-year, and draw the straight line Oh, this line will represent by any ordinate the yearly charge per kilowatt against the water power for any proportion between steam and water power. For it is clear that if we have one-half water power then the yearly charge per kilowatt against the entire 100 per cent. load is $11. (In comparing the cost of power we must of course include total cost of delivery to center of load.)

Similarly, if we take the yearly fixed cost per kilowatt of steam power as Os, taken in the figure as $11 per kw-year, and draw the line O_1s, this will represent by any ordinate the yearly charge per kilowatt against the steam power for any proportion between steam and water power.

The straight line sh then represents the total fixed charge against the steam and hydroelectric power for any proportion of steam and water power (Oh and O_1s being straight lines and sh being derived by adding the ordinates, gives another straight line).

For example, let total load equal 100,000 kilowatt, divided 70 per cent. hydroelectric and 30 per cent steam; then the yearly charge against the water power and steam will be

Water power, fixed charge	70,000 kw.	× $22	$1,540,000
Steam power, fixed charge	30,000 kw.	× $11	330,000
Total power, fixed charge			1,870,000

or $18.70 per kw-year, as shown by the ordinate of the line sh at 70 per cent water power, 30 per cent steam power. All water power fixed charge would cost $2,200,000 and all steam power fixed charge $1,100,000 per year. All steam power costs $4,400,000.

For any other assumption of cost per year of water power or steam power, it is only necessary to determine the yearly fixed charge against steam power Os and water power Oh and draw the line sh, and we have immediately the total fixed charge for any proportion of water power and steam power. This very much simplifies the problem and visualizes the results.

To determine the total charge per kw-year against the combined steam and water power, it is necessary to add the kw-hr. charge against the steam power. It is of course assumed that all charges against the water power are fixed charges.

To determine the yearly charge against steam power for any load factor we must start with the load curve of the power system. The load curve assumed is that shown on the left of Fig. 2. The ordinates, it will be noted, are plotted in percentage of the load, the peak load being 100 per cent.

Now we must determine the kw-hours carried by steam for any percentage of the total load carried by steam, it being assumed of course that the steam power takes the load off the top of the curve. For this purpose we determine the curve of kilowatt-hours to be carried by steam power when 10 per cent., 20 per cent., etc., of the top of the load curve is carried by steam. To do this we take the area of the load curve above 90 per cent. for example, and determine what percentage this is of the entire area of the load curve. Similarly for areas above 80 per cent., 70 per cent., etc. The results are shown in the curves to the right of the load curve.

For example, if all load over 80 per cent. is carried on steam, we get the steam load factor=17 per cent. and steam

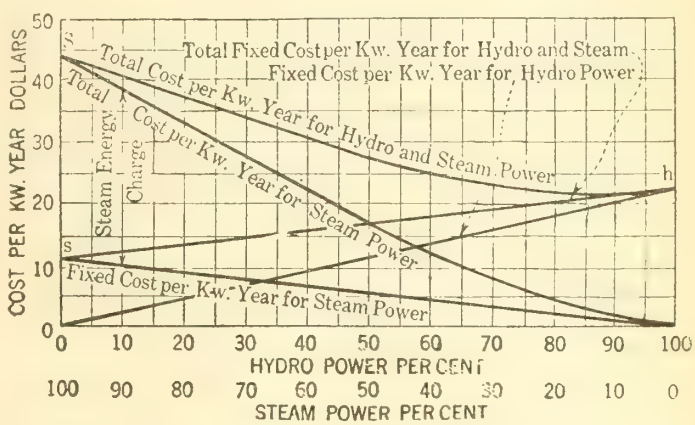


Fig. 1—Proportion of Water to Steam Power
Water power cost per kw.-yr., $22.00
Steam, fixed cost per kw.-yr., $11.00
Steam energy charge per kw.-yr. and 100 per cent. load factor, $44.00

kilowatt-hours 6 per cent. of the total as shown by oa and cd. Also we get a hydroelectric load factor 87 per cent. and kilowatt-hours 94 per cent. of the total as shown by ob and oc.

From the curves in Fig. 2 and the cost per kilowatt-hour of fuel and other strictly steam energy charges, we determine for any percentage of load carried by steam power the yearly energy charge per kilowatt-year. Assuming $33 per kilowatt-year for energy charge where all the energy is supplied by steam for the particular load curve under consideration (which corresponds practically to $44 per kilowatt-year, or 0.5 cent per kilowatt-hour for 100 per cent. load factor, as the load factor of total load is 75 per cent.) and adding the energy charge to the fixed charge for steam power, we obtain the total cost of steam power as shown by the curve "cost steam power" O_1S in Fig. 1.

To obtain now the total cost of all power for any proportion of steam power to water power, we add the ordinates of oh the "fixed cost of hydro-electric power," to the or-

*Before the A. I. E. E.

...ates ... the total cost of the power" and obtain the ... "The total cost per kilowatt year hydroelectric and ... power" This curve starts at $22 per kilowatt-year if ... power is water power By adding some steam power to take off the peaks, we see there is a slight decrease in the yearly charge until the steam power carries about 15 per cent. of load. At 20 per cent. of load the cost again comes to about $22 per year, and then a gradual increase in power cost results.

At 30 per cent. load carried by steam for this particular load curve there is little difference in the yearly charge per kilowatt and we would not for this case be warranted in installing less than 30 per cent. steam; for naturally, unless very material savings result, the decision will always be to install steam power because of the smaller capital cost.

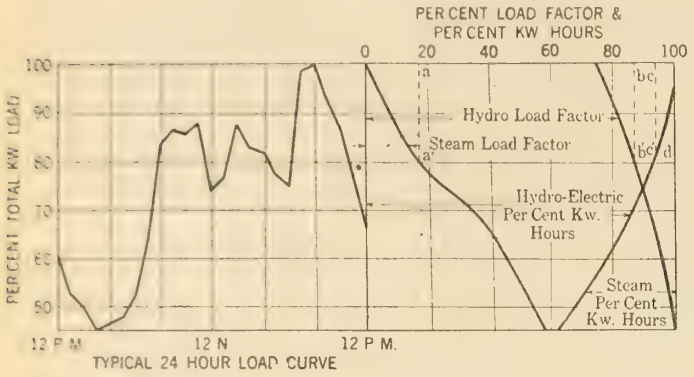


Fig. 2—Load Factors and Kw.-hr. for Steam and Water
Example:
... 20% ... load carried by steam and 80% by water the curves show
Steam load factor = 17% = o a
Water load factor = 87% = o b
Water kw.-hr. = 94% = o c
Steam kw.-hr. = 6% = c d

Note—Steam carries everything above 80% line in example, and the curves will show per cent. load factor and per cent. kw-hours for any other per cent. load taken.

At 50 per cent. of total load taken by steam installation and 50 per cent. by water power, we have the yearly charge as follows:

50 per cent. x $22—$11.00—yearly fixed charge water power
50 per cent. x $11——5.50—yearly fixed charge steam power
Total .....$16.50—yearly fixed charge total power

At 50 per cent. load factor practically 33 1-3 per cent. of the kilowatt-hours are carried by steam and this adds the energy charge of $33 x 33 1-3 per cent. or $11. Therefore the total yearly charge is $16.50 x $11=$27.50, as shown by the curve hS by the ordinate at 50 per cent. The added charge over all water power costs here is $5.50 per kw. year, but on a system with 100,000 kw., the yearly excess charge is $550,000. a very substantial sum.

The curve of total yearly power costs per kilowatt shows graphically what we want to know, and after we have the curve of energy cost of steam power at various load factors, we can very quickly make up total costs per kilowatt-year for any assumption of fixed cost of hydroelectric and steam power. It is believed this method will assist engineers in their work. The actual proportion of steam to hydroelectric power will of course be somewhat influenced by service insurance conditions.

This paper is merely an outline of the general principles and gives the general method to follow. There are, of course, many details and different conditions in different sections of the country. It is hoped that the method presented will appeal to engineers and managers.

The Hydro-electric Commissioners of Peterboro, Ont., have suggested that the city purchase the local street railway system. A meeting of the council will be called to discuss the matter.

First Electrically Welded Ship Launched

The advent of the electrically welded ship establishes another milestone in the shipbuilding industry responsible for many surprises in its efforts to cope with the situation caused by marine loses. An article recently published in the "Engineer" furnishes us with our first information of authority, and contains comparisons of great interest:—

Electrically-Welded Barge.

Particulars are now available of the interesting—and completely successful—experiment in rivetless shipbuilding, carried out at a yard on the South-East Coast. The first steel vessel constructed entirely without rivets was recently launched in the presence of Lord Pirrie, the Controller-General of Merchant Ship-building and, other representatives of the Admiralty and the war-office. She has since been in service with full cargo during exceptionally rough weather, and has, we understand, passed satisfactory in every way through the severe tests imposed.

The object of the experiment, to which considerable importance was attached by shipbuilding authorities, was to prove the ability of welded construction to withstand the stresses peculiar to a ship at sea. This principle having been established, it is not proposed altogether to dispense with riveting, which in certain sections is cheaper and quicker than welding; it is intended, however, that future vessels should be a combination of riveting and welding. The United States Shipping Board, for instance, having been in close touch with the experimental work, is making arrangements for the construction of a number of 10,000-ton standard ships, in which the use of rivets will be reduced to 2½ per cent. of the number originally required.

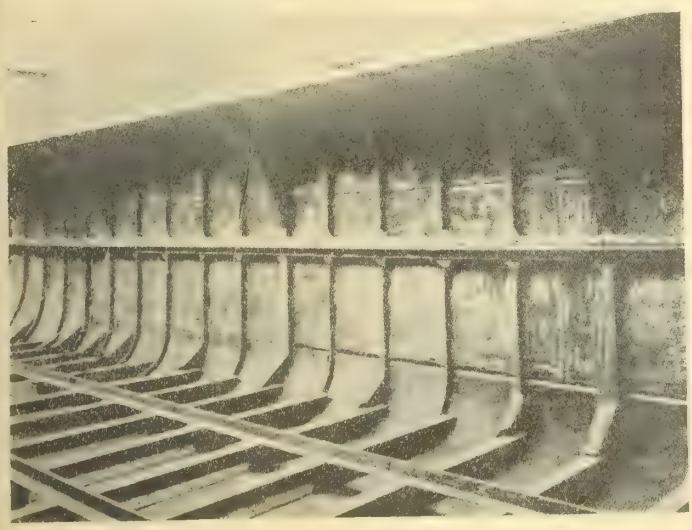
The recent progress achieved in electric welding by means of the flux-coated metal electrode process, and its successful use at Admiralty dockyards and elsewhere in the construction of the equipment and superstructures of various vessels, led to premission being obtained for the erection of a standard barge, with riveting eliminated and electric welding substituted throughout. Such a craft, it will be observed, may be exposed to considerable rough usage in dock, besides being subjected to severe towing stresses. Seeing that material already available on the site where she was built was utilized, the barge differs in no way from the standard riveted type with lapped joints, excepting that the hull plates were arranged for clinker build and the plate edges joggled to permit of horizontal downward welding in order to reduce the amount of overhead work, which is more difficult of execution.

The vessel to be welded was 125 ft. between perpendiculars, and 16 ft. beam, with a displacement of 275 tons. The hull was rectangular in section amidships, with only the bilge plates curved. It was built up of seventy-one transverse frames, and contains three bulkheads, those fitted fore and aft being water-tight and that amidships non-water-tight. The shell plating was ¼ in. and 5-16 in. All the joints were lapped in the manner described.

Curiously enough, the first day's work was poor, though all the operators were first-rate men, with extensive experience of electric welding in the shop on minor repairs and on structural work at shipyards. The poorness of the work was probably due to the novelty of the undertaking and to the position—lying flat on the keel—which the men had to adopt to get to the joints. In a few days, however, when they became accustomed to the job, the speed and quality of the work improved so as to become equal that achieved in workshop standard practice. With the more difficult welding, such

as that in the vertical butt joints on each shell plating, and overhead work underneath the keel and on bilge plates it was noted that the quality of the welds was excellent. For this overhead work special electrodes were employed, and proved well worth the slightly increased cost. All water-tight joints up to and including the underside of bilge plates were continuously welded both inside and outside, the other water-tight joints being welded continuously on one side and tack welded on the other. On the shell plating the continuous welding was on joints and frame construction tack welding was adopted, the length of welding being carefully calculated to give a margin of strength over a similar riveted joint. Taking all positions of work into consideration, the average speed was 4 ft. an hour at the commencement, while towards the end of the work an average of 7 ft. an hour was easily obtained.

Some interesting details have been given to us of the comparative cost of an electric welded and a riveted barge.



View showing welded shell plates and transverse frames

In labour, 245 man hours were saved in construction, which can easily be improved on in future work. More than 1000 lb. of metal was saved, owing to the absence of rivets, but it is estimated that greater economy will result when the design is modified to suit electric welded ship construction. The total cost of welding was £301, detailed as under:—

Electrodes	£178
Electric current	61
Men's time	62
	£301

It is realized by the Admiralty experts that the proportion of cost for electrodes is high, but this is mainly due to the present limited demand. Demand and competition will have the usual effect, and should reduce the cost of this item by at least 60 per cent. It will then be possible to build a vessel of this size with an estimated saving of from 25 to 40 per cent. of time and about 10 per cent. of material.

It is interesting to add that, as a result of this demonstration, the yard has prepared a new design of barge, in which it is proposed to incorporate electric welding and riveted construction to the following extent:—

To Be Welded.

Coamings.
Shell seams to frames.
Deck butts to beams.
Bulkheads (including boundary bars.)
Keel plate butts to be welded overlaps.
After shell seams welded

To Be Riveted.

Floor riveted to frames.
Beam knees to frames and beams.
Frames clear to shell seams.

Water Power for the Empire

There has just been issued the preliminary report of the Water Power Committee of the Conjoint Board of Scientific Societies. The Board was appointed by the British authorities some time ago to investigate and report upon various scientific and industrial problems the solution of which was considered vital to the present and future welfare of the Empire. A committee of this board was appointed "to report on what is at present being done to ascertain the amount and distribution of water power in the British Empire."

This Committee under the chairmanship, of the eminent engineer and inventor, Sir Dugald Clerk, is composed of men whose reputation as water power and engineering experts is world-wide and including as it does representatives from Canada and other Dominions, is fully qualified to speak with authority.

The Report states that "To enable the Empire to recover, with any degree of rapidity, from the financial burden imposed by the war, it will be necessary to develop, in a much greater degree than heretofore its latent resources" and adds that "it must be realized that without an ample supply of cheap energy much of this wealth must always remain latent."

It is estimated that the power now being used all over the world is in the neighborhood of 120 million h.p. of which shipping uses 24 million, railways 21 million horsepower, the remainder being used in factories and public utilities. This power is developed roughly as follows, 13 millon horsepower in the United Kingdom, 24 in continental Europe, 29 in the United States, 6 in the British Dominions, while Asia and South America only use 3 million. Of this total amount between 15 and 16 million horsepower is developed hydraulically.

The report proceeds to treat of the Empire water power possibilities, the reasons for the neglect in the past, recent developments including nitrogen fixation, and then gives in such detail as is possible the resources in the British Isles and in other portions of the Empire, dwelling at considerable length on the water power situation in Canada.

The main conclusions drawn from the evidence available by the Committee are:—

1. That the potential water power of the Empire amounts in the aggregate to at least 50 to 70 million horsepower.

2. That much of this is capable of immediate economic development.

3. That except in Canada and New Zealand, and to a less extent in New South Wales and Tasmania, no systematic attempt has as yet been made by any Government Department to ascertain the true possibilities of the hydraulic resources of its territories, or to collect relevant data.

4. That the development of the Empire's natural resources is inseparably connected with that of its water powers.

5. That the development of such enormous possibilities shall not be left to chance, but should be carried out under the guidance of some competent authority.

The report concludes with a number of recommendations which urge the British Government to bring to the attention of the overseas Governments the necessity for a close systematic investigation of all reasonably promising water powers and of their economic possibilities. In event that any government is unable to undertake such work it proposes that a British of Imperial Water Power Board be appointed to control such investigation, such Board, which shall include a representative each from the Dominions, shall also act in an advisory capacity to the Imperial or overseas governments. It also suggests a policy of state-aided water power development.

Get More Heat Out of Your Winter Coal

In view of the universal coal shortage and the consequent wide-spread interest in conserving this commodity wherever and by whatever means possible, we feel justified in printing the following general suggestions on the operation of household heaters, as offered in a recent publication, "Fuel Facts," issued by the U. S. Fuel Administration:

How to get more heat out of your coal than the chimney does, is more important than any other branch of household economy. In the average home 25 per cent. of the coal used can be saved. Most of this saving can be accomplished by proper damper control. Tests have shown that only 40 to 50 per cent., on the average, of the heating value of the coal is usefully employed in heating a house or a building. Under conditions of proper installation and frequent and careful attention, 50 to 60 per cent. of the heating value may be converted into useful heat, while under unfavorable conditions only 25 per cent., or even less, of the heat value of the coal is utilized.

There is no more important general rule than the one emphasized by L. P. Breckinridge, of the Sheffield Scientific School of Yale University, to this effect:

The flow of air through the fuel makes it burn. Learn to control it. Try to visualize this flow of air through the fuel and you will easily learn how to operate the dampers to control it properly . . . The draft of the chimney is much diminished when by opening the check-damper cold air is allowed to flow directly into the chimney.

Save, to Help Win the War.

The Fuel Administration's first charge to the householder is cleanliness. To get the most heat from the least amount of coal his heater must be clean. One one-hundredth inch of soot has the same power to resist heat as ten inches of iron.

The Fuel Administration asks the head of each household to care for his heater himself this winter; to learn how to run his heater intelligently; how to get from every ton of coal every unit of heat it can supply to his family.

Give your heater its first cleaning of the season in the late summer and have it put in thorough repair. Broken parts mean loss of heat. The fire-box should be tight. Trivial cracks may be cemented.

Following are fuel savers and comfort suggestions, assembled briefly in the form of practical rules for operating the various types of household heating systems:

General Rules.

1. Be sure there is a check draft-damper in the smoke-pipe, besides the turn-damper. This check draft-damper is as important in controlling the rate at which the fire burns as is the throttle of an engine. Open it to check the fire. Close it to make the fire burn more rapidly. Experiment with it in the daily regulation of your fire. Make it do its work. The coaling-door was not put on the heater to check the draft. If you cannot check the fire without opening the coaling-door, you need proper dampers.

2. The turn-damper should fit the smoke-pipe loosely and must never be entirely closed. With the average plant it may be kept partly closed most of the time in mild weather, but during severe weather it usually needs to be opened wide.

3. Make use of the lift or slide-damper in the coaling-door only to let oxygen in to consume gases, if you are using soft or bituminous coal after fresh fuel has been added.

4. Just enough draft and that from below, checking the draft by letting more air into the smoke-pipe, is one of the best general rules. This furnishes oxygen from below, necessary for the consumption of the coal-gases, and at the same time gives time for them to be consumed before being drawn up the chimney. This method also avoids escape of coal-gas into the cellar. To make the fire burn more rapidly, do not open the whole ash-pit door, but only the draft-damper in the ash-pit door. Opening the whole ash-pit supplies air to the fire faster than it is needed for combustion. The air is heated, passes out of the chimney and is so much heat wasted.

5. All heat pipes in the cellar should be thoroughly and completely wrapped with asbestos or similar covering to prevent loss of radiation.

6. Grates should be cared for properly. A short, quick stroke of the shaker handle will sift the ashes through the grates. Leave grates in flat position when through shaking. Clean ash-pit daily, to prevent damage to grates. In severe weather grates should be shaken until a glow appears in ash-pit. In moderate weather a bed of ashes should be carried on top of the grates.

7. Avoid poking and slicing fire-bed. It causes draft holes and clinkers.

8. Never shake a fire that is low until you have put on a little fresh coal and given it time to ignite. A thin fire wastes coal. Disturb the fire as little as possible.

9. Storm-windows and storm-doors, weather-strips and such protective devices are economical of heat.

10. Keep the temperature of sitting-rooms at sixty-eight degrees or less. If there are invalids, old folk or very little children in the family, the temperature may be higher. Rooms where you do not sit are more comfortable if much cooler, as a rule, providing the air is kept a little moist. Get a thermometer—a good one. Use it inside, not hanging outdoors.

11. It is wasteful to allow the temperature to drop way down at night. It takes twice as much coal to heat it up again next morning.

12. Turn off the heat in unused rooms whenever possible. Bedrooms should be kept much cooler than living rooms. Don't try to heat all the rooms all the time. If you have a hot-water system, make heavy radiator slip-covers and put them over radiators when not in use. This will prevent freezing.

13. Always keep two pans or open-top jars of fresh water on radiators or in front of registers to keep the air in the home moist.

14. Study the Specific Rules applying to the system of heating in your house.

Hot-Air Furnaces—Specific Rules.

1. Provide cold-air drops from upper floors so as to insure a return circulation from all rooms to the air intake of the furnace.

2. Regulate the window of the cold-air box so as to avoid too great a current of outside air, especially on very cold days.

3. Always keep the water container in the air-jacket filled with clean water. Moist air heats much more readily than dry air, and is better for health, as well as more comfortable.

4. It is advisable to keep a jar of water near one of the first-floor registers that sends out the most heat. Change the water frequently, preferably every day.

5. Hot-air pipes should have a good pitch upward from the furnace, and should be of sufficient diameter. They

should also be wrapped with sheet asbestos. A separate pipe for each room with a turn damper near the furnace is a good rule. Each pipe should be labeled, so that certain rooms can be shut off at the furnace when desired.

6. Be sure the fire-box is gas-tight. All cracks must be thoroughly cemented or a new section put in before winter sets in. Otherwise coal-gas will escape into the air-jacket and be carried up directly to the rooms.

7. Study carefully the General Rules pertaining to other types of heating-plants as well as your own. Notice the "clean-out" door and remember why it is there.

Steam Heaters—Specific Rules.

1. The water in the boiler should be completely changed at least as often as every spring and every autumn. Draw a bucketful of dirty water from the bottom at least twice a week and each time replenish with fresh water from the supply-pipe. Cleanliness of water in the boiler is prime importance.

2. Look at the glass water-gauge whenever you attend to the fire. Turn the exhaust-cocks above and below the gauge occasionally to make sure that it is not clogged or the openings to it from the boiler closed up. They must be kept open.

3. The level of the top of the water must always show at some point along the gauge. Its height will vary with the temperature of the water; but if it rises about the top of the glass there is too much water in the boiler and some must be drawn off; and if it sinks below the bottom of the glass some more water must be let into the boiler.

4. Be sure that the exhaust-valve of each radiator works. Sometimes these valves need cleaning with a pin or soaking in kerosene. If in doubt about one of them unscrew it from the radiator when the fire is low and there is no steam-pressure, or else after turning off the radiator. If you can blow through it, it is all right. If not it must be cleaned until you can. Don't fail to replace it. It is advisable to have an extra valve to replace any one that is temporarily out of order.

5. Don't fail to study the General Rules, applicable to all heating-plants, and also to keep the boiler-flues clean.

Hot-Water Plants—Specific Rules

1. All the water should be emptied from the plant and clean water put in at least as often as every spring and every autumn.

2. When the first fire of the season is built, as the water gets heated, take the raidiator key and open up the exhaust-valve of each radiator in turn until all the air remaining in each radiator is allowed to escape. Repeat this operation occasionally to make sure there is no air interfering with free circulation of the water.

3. Always be sure that water shows in the glass gauge of the exhaust tank, which is usually located in the top story of the house above the level of the radiators.

4. Be sure the boiler is covered with asbestos, as well as the pipes in the cellar.

5. Study carefully the General Rules relating to all types of plants. Keep heating surfaces of the boiler well cleaned.

The Kitchen Range.

1. Avoid too much shaking. Live coals in the ash-pit mean wasted fuel. Clean ash-pit daily to prevent damage to grates.

2. Clean the entire stove well inside, on top of the oven and below the oven, frequently and thoroughly.

3. Stoke frequently and in small amounts.

4. Never shake a low fire until a little fresh coal has been added and given time to ignite.

5. Keep a pan or kettle of water always on the kitchen stove. Moist air makes for comfort, health, beauty and economy.

6. Read the General Rules applying to all household coal-burners.

Advantages of Moist Air in Rooms.

As humidity of the atmosphere controls the distribution of the sun's warmth upon the earth, so does moisture in the air of the home have a controlling influence upon its comfort. If the air in a room is dry, the heat from stove, register or radiator, strikes through this dry air readily, and, without being absorbed, rises quickly to the ceiling; while if the air is moist the heat is absorbed and the general temperature of the atmosphere of the room is perceptibly raised.

Clouds have a cooling effect on a hot day because they are masses of moisture, absorbing heat from the sun's rays before it reaches the earth.

While a damp climate is enervating in hot weather and biting in cold weather, nevertheless, a moderately moist atmosphere in the temperate warmth of the living rooms adds to comfort and works for economy and health. The air of heated rooms is nearly always too dry.

In dry air the evaporation from skin, throat and lungs is increased; illustration of this is the fact that woodwork and furniture usually swell when exposed to the natural summer atmosphere, while they shrink and crack in heated rooms in winter.

It is advisable to keep a bowl or open jar or two of fresh water in each heated room, giving the air a chance to absorb moisture from them rather than from your body and the furniture.

Electric Railway and Power Rates Increased by General Statute

The following are extracts from the text of the Statutory Undertakings (Temporary Increase of Charges) Bill which, as amended, was read the third time and passed by the British House of Commons on July 24 and by the House of Lords on August 2. It received the Royal Assent on August 8. The Bill enables the statutory provisions affecting the charges which may be made in respect of certain undertakings, including tramways, to be modified during the continuance of the present war, and for two years thereafter.

1. (i). Where it appears to the appropriate Government department that the financial position of any undertaking to which this Act applies has been adversely affected by circumstances arising out of the present war, the Department may, if they think fit, by order provide for the modification of any statutory provisions regulating the charges to be made by the undertakers, and of any statutory provisions consequential on or supplemental to any such provisions as aforesaid, for such period during the continuance of this Act, in such manner, and subject to such conditions, as appear to the Department to be just and reasonable:

(a) Where the undertakers are a local authority no modification shall be authorized which will increase the statutory maximum charge by more than 50 per cent., or which is more than sufficient so far as can be estimated to enable the undertaking to be carried on without loss; and

(b) In any other case no modification shall be authorized which is more than sufficient to enable with due care and management a dividend on the ordinary stock or shares of the undertaking to be paid at three-quarters the standard or maximum rate of dividend, if any, prescribed for the undertaking, or at three-quarters the pre-war rate of dividend, whichever is lower.

(ii.) An application to a department for the purposes of this Act shall be accompanied by such information, certified in such manner as the department may require with respect

of the financial position of the undertaking in question, and before making an order the appropriate Government department shall require the undertakers to give public notice of the application for an order under this Act and as to the manner in which and time within which representations may be made, and to give a similar notice in writing to the council of each county, borough, or urban, or rural district within which any part of the undertaking or limits of supply of the undertaking is situate, and the department shall consider any representations which may be duly made.

(10.) The undertakings to which this Act applies are tramway undertakings, including light railways constructed wholly or mainly on public roads, and undertakings for the supply of gas, water, hydraulic power and electricity.

The act is applicable also to Scotland and Ireland.

Montreal Tramways Fares

As the result of the appeals to the Quebec Public Utilities Commission, the latter have issued a new schedule of fares to be charged by the Montreal Tramways Co. which is a compromise between the fares favored by the Tramways Commission and those asked by the Company. The Public Utilities Commission have directed a cash fare of 6c or 25c for five tickets during the hours from 5 a.m. to midnight; working men's tickets from 6 to 8 a.m. and 5 to 7 p.m. will be secured at the rate of 6 for 25c, and school children 7 for 25c. From midnight till five o'clock in the morning the cash fare is 15c. The Tramways Commission reported in favor of a 5c fare with a cent transfer, and the Tramways Company desired a 7c fare with free transfers. The Public Utilities Commission in their judgment deal at length with the arguments of the Company and those who objected to an increase in fares, and state that the increases allowed is a matter of maintaining the undertaking as an efficient and going concern. Urban transportation was essential, and it could not be long maintained at less than cost. The report says:

"This has had to be recognized the world over, and is a consequence of the abnormal conditions through which we are passing. In all spheres of activity, transportation among the rest, prices and rates have been increased, and we have not gone farther in this direction than necessity and the terms of the contract appear to demand."

Personals

Mr. J. N. Mochon has been appointed assistant superintendent of the lighting department of the City of Montreal.

Captain Paul F. Sise, vice-president of the Northern Electric Co., Montreal, has been given a command in the Canadian Siberian Expedition.

Mr. E. J. Stapleton, secretary of the Water & Light Commission at Collingwood, has been confined to his house with inflammatory rheumatism. Mr. Stapleton is now reported to be well on the road to complete recovery.

Mr. W. G. Gordon has severed his connection with the Railway and Power Engineering Corporation and returned to the Canadian General Electric Company where he now holds the position of Transportation Engineer.

Mr. C. J. DeBats, who for the past four years has been manager of the Walkerville Hydro-Electric System and recently manager of the Essex County System, has resigned his position with the Commission to accept a position in his home, Bay City, Michigan. Mr. DeBats has been appointed manager of the Bay City Light & Power System.

Mr. A. Winfield, district superintendent for the Maritime Telegraph and Telephone Company in Cape Breton, has been appointed superintendent of all the company's plants with headquarters at Halifax. He will be succeeded by Mr. J. A. MacKinnon, district superintendent for Pictou County. Mr. Winfield was at one time general manager of the Prince Edward Island Telephone Company, Charlottetown.

Mr. R. J. Needham has been appointed mechanical and electrical engineer, motive power and car departments, Grand Trunk Railway, with headquarters in Montreal. Mr. Needham is a graduate of McGill University in electrical engineering. He was formerly on the staff of the Detroit Edison Company, at the Delray power plant. Since 1911 he has been on the electrical engineering staff of the Grand Trunk Railway system.

The Senneville Development Co., Ltd., has been incorporated with a capital of $20,000 to generate and transmit electricity for the company's business and to sell the surplus in the parish of St. Anne, Jacques Cartier County, P.Q. The head office is in Montreal.

Plan to Hear Mr. Goodwin on October 15

"The Goodwin plan has been printed and re-printed time and again, but some way or other there is considerable misapprehension on the part of many electrical men as to just what the actual interpretation of his plan may be. Perhaps the whole situation is best explained by saying that Mr. Goodwin simply advocates the exercise of common sense in the solution of the electrical problem. Indeed, after reading his platform one cannot resist the temptation to say, 'Why, of course, that is the natural thing and just what I have always advocated.' Mr. Goodwin does not raise any contentious points, does not ask any one element in the industry to sacrifice anything to any other element. His plan means a common benefit to all interests concerned. In studying Mr. Goodwin's platform, therefore, do not look for anything difficult to understand. Do not try to read anything in between the lines. His scheme is as simple as it looks, and it looks as if it would work out very simply."

Mr. Goodwin speaks at the King Edward Banquet, Tuesday Evening, Oct. 15, 6.30. We believe his message is of sufficient interest to command the attendance of every manufacturer, retailer, central station man, dealer and contractor. Those who have heard Mr. Goodwin explain his plan claim that it is simple, effective and comprehensive.

The Dealer and Contractor

News from the Front Lines—Mr. Earle's Ambition to Get Home and Settle Down as a Quiet Citizen

Another typical letter has just come to hand from Mr. Rufus Earle who, at latest report, is still vigorously carrying on in France. The following extracts are of special interest:—

In the Field, August 12th, 1918.

"I see by the Canadian Daily Record, the paper published daily by the Record Office for circulation among Canadian troops in the field, that you have been having strenuous times in Toronto of late, and that Tommy threatens to read the Riot Act if the disturbances are not stopped. I am not greatly in sympathy with the aims and conduct of the Great War Veteran's Association, and kindred bodies, and think that they have been formed principally as mutual admiration societies to keep the claims of the soldier ever in the public eye. My greatest ambition just now is to get home and settle down as a decent quiet citizen, and forget that I ever was in khaki. They seem to be so proud of the fact that they donned the uniform that they insist on advertising the fact, and perpetuating the memory. Virtue will be its own reward, and I think that few of us are looking for any particular rewards, except some of the ranters, and I feel that if the truth were known the men who are talking the loudest and making the greatest display of their so-called patriotism were the men who saw the least of the fighting. While the war has changed us all a great deal, not only physically but mentally, I really think that the average boy who enlisted will go back much the same as when he left, except that his horizon in his views of life will be greatly widened, and his experience out here, where human life is held so cheaply will tend to make him more generous in his ideas, and less self-centred.

"If you will remember when you receive this letter what was happening in the war zone at the time I wrote it you will know that we are in the midst of strenuous happenings these days, and events that forbode good times for us for the future. I was down to a prisoners cage near here the other day, and a large party of the captured Huns were being marched in by a party of husky Americans. One of the U.S. Sergeants and myself had quite a talk, and he was telling me a rather funny incident. There was a German Major in the party, who spoke rather good English, and he inquired from this sergeant where he came from. The Sergeant replied that he came from Chicago, whereupon the Major went into details regarding relatives that he had living in Chicago. The Sergeant "Do you know where these people are now?" to which the Major replied "No." "Well, they are over here looking for you" was the Sergeant's reply. A pretty good answer I thought. Of course we don't know yet the full story of these operations of the past few days, but by the time this letter reaches you they will have been history, and it looks as if it will prove one of the most brilliant, if not the most brilliant success of this war. Just at present all kinds of rumors are rife. Naturally as advances are made it is necessary to establish good lines of communication, and as a sequence, we are very busy just now.

"I had just gone to bed the night before last when I heard Bosche bombing planes overhead, and went out just in time to see one Gotha neatly focussed in the rays of about four of our powerful searchlights, and just about 100 ft. above the Bosche machine could be seen the signal light of one of our planes. Just as I got to the door our man opened up on the Heinie with his Lewis Gun, and you could follow the string of red hot bullets from his gun to the enemy plane quite distinctly in the dark. All of a sudden Mr. Hun bursts into flames, and makes a perfect nose dive from the ground. It was over in a matter of seconds. This is the first plane I have ever seen brought down at night.

"I am most anxious to get down and visit my old Battalion as soon as I possibly can, and see how the boys fared in the recent strenuous fighting. Of course, we all know that the Canadians have so far given a magnificent account of themselves, and have added to their glory in this battle. However, I am naturally anxious about some of my good friends in the Battalion, and would like to know how things went with them. Just at present, however, our motor transport is so busy that it is doubtful if I can get a car to run down for a few days yet. However, by that time things will have quietened down, and I may be able to spend a day with them if they are out of the line then. Yesterday mail came in from Canada postmarked Toronto July 24th, making 18 days for the journey, which is rather remarkable. I did not get any letters, but am looking forward to getting some in to-night's mail when the balance of this Canadian mail will reach us.

"The chap with whom I was on leave last year (I think I sent you a snap taken at Versailles of the two of us) has left the 116th Orderly Room, and when last I heard from him he was down at the Canadian Corps School taking a general infantry course, which was to be completed on August 5th. This would bring him back in time for the rush, and as he had left the Orderly Room, I am afraid that probably he went in as a platoon sergeant, and I am greatly worried about him. I sometimes feel that I am so far away from the actual big things in this war since I transferred that I am not doing any useful work, and have a longing to get back to the heart of things, so do not be surprised if you hear shortly that I have again changed over. Of course, if I do go back, this time I want something better than I had when I was there previously, and I am for that reason for one, anxious to get down to see the Canadians, to see how the land lies."

The Square D. Company, safety switch manufacturers, announce the appointment of Mr. R. J. A. McCleary to succeed Mr. John Plate as manager of their office and factory at Walkerville, Ontario. Mr. McCleary was formerly purchasing agent for the Square D Company, Detroit, and has been with them for about three years. Mr. Plate has resigned to enter the United States army and will be stationed for the present at Fort Dodge, Iowa.

The Ontario Association of Electrical Contractors and Dealers

A special meeting of the Toronto Electrical Contractors' Association was held in the King Edward Hotel on Thursday, September 26, regarding the organization of "The Ontario Association of Electrical Contractors and Dealers." The notice of this meeting reads as follows:

To All Members of The Toronto Electrical Contractors Association.

Hereby take notice of a Special Meeting at which the following Resolution is to be presented for adoption:

WHEREAS, in the opinion of the Executive Committee it is considered desirable to organize an association to be known as "The Ontario Association of Electrical Contractors and Dealers," in affiliation with the National Association of Electrical Contractors and Dealers forming a part of the Canadian division of the said National Association of Electrical Contractors and Dealers:

AND WHEREAS application has been made for a charter to incorporate the said proposed "The Ontario Association of Electrical Contractors and Dealers" under the Ontario Companies Act:

THEREFORE be it resolved that this Association approves of the said proposed incorporation.

AND be it further resolved, that upon the incorporation and organization of the said proposed "The Ontario Association of Electrical Contractors and Dealers" this "The Toronto Electrical Contractors Association" shall be deemed to be merged in the said proposed "The Ontario Association of Electrical Contractors and Dealers."

AND be it further resolved that all members of this "The Toronto Electrical Contractors Association" shall be deemed ipso facto members of the said "The Ontario Association of Electrical Contractors and Dealers."

AND be it further resolved that all the moneys and assets of this "The Toronto Electrical Contractors Association" be turned over and conveyed to the said "The Ontario Association of Electrical Contractors and Dealers" and that this resolution shall be authority to the Treasurer and other officers of this "The Toronto Electrical Contractors Association" in that behalf.

E. F. W. Salisbury,
Secretary.

Smoke Prevention—Coal Saving Suggestions

Just at this time when the conservation of coal is an absolute necessity and every practical suggestion for such conservation is a shot at our enemy, everyone realizes that smoke issuing from boiler stacks represents unused heat units, but everyone does not realize that certain simple rules, if observed in the fire room, will materially decrease this loss. The suggestions herein are based on many years' experience of the Westinghouse Electric & Mfg. Company's combustion engineers and are briefly outlined below.

1. Give your fireman an opportunity to acquire the fundamental principles of fuel burning.

2. If you have a difficult fuel problem, consult a combustion engineer.

3. Prevent smoke by proper firing methods.

4. Use gauges to indicate exactly the condition of fire bed at all times. As a minimum these gauges should consist of draft gauge indicating draft in furnace above fuel bed, draft gauge indicating draft at boiler side of flue damper and a steam flow meter for individual boilers.

5. CO_2 is the principle product of complete combustion of coal. Ten to twelve per cent. CO^2 should be obtained in flue gases to insure minimum fuel loss.

6. Avoid loss due to unburned coal in the ash.

7. If you are wasting exhaust steam, you are wasting coal.

8. Do not permit grates to clog. A systematic method of keeping the air spaces clean must be followed.

9. Inspect the baffles in boilers as broken or leaky baffles raise the flue gas temperature and waste coal.

10. Avoid leaking in of cold air around boiler setting.

11. Install stokers. Hand firing is rapidly being recognized as an obsolete and wasteful method of firing.

12. Clean scale from tubes as every particle of scale represents wasted coal.

13. Avoid soot formation. All boiler tubes should be blown externally once every eight hours when in continuous service.

14. All smoke flues should be as short and straight as possible. Flues should also be made air tight and all joints and connections should be well fitted, caulked and riveted. Use asbestos gaskets on clean-out doors.

15. Locate flue dampers in front of boiler so that fireman will adjust them as required. Dampers located in rear of boilers are seldom disturbed regardless of conditions.

16. The size of coal has much to do with capacity and efficiency of boilers. In general, the air pressure penetrates the fuel bed formed by coarse coal easier than that formed by finer coal, resulting in disturbance of best furnace conditions.



Mr. W. L. Goodwin, who will be the chief speaker at the Electrical Men's Banquet on Tuesday, Evening, October 15, 6.30 p.m.

In addition to the above suggestions, the following "don't fail to do" list should be followed.

Don't fail to:—

Keep the heating surface of the boilers free from soot, scale or oil.

Keep the fires level and free from holes.

Do not carry the fires so thin as to draw a lot of excess air through.

Do not carry the fires so thick as to have incomplete combustion of the coal.

Do not soak the coal with water before firing.

Be sure the blow-off valves do not leak.

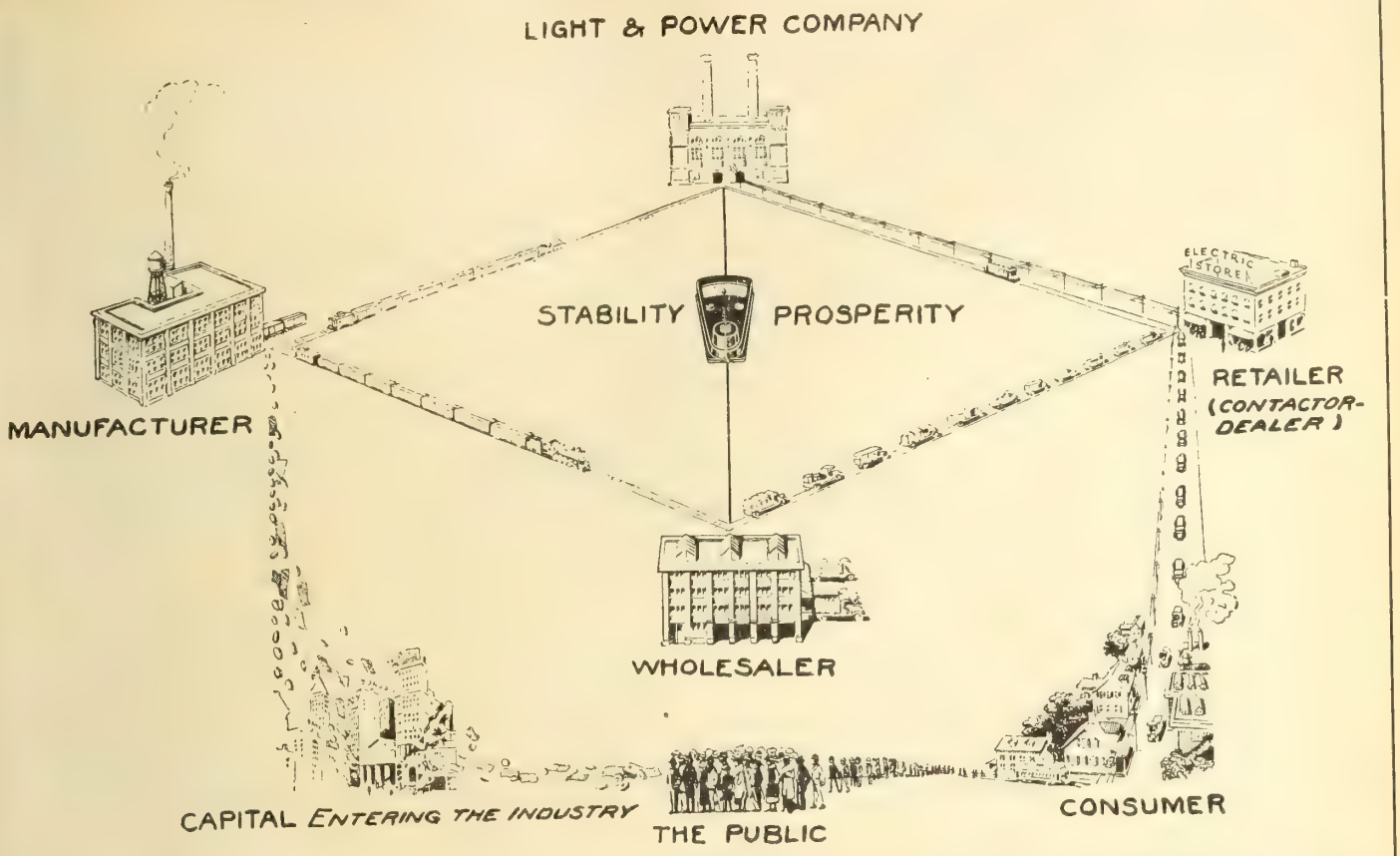
Do not have the safety valve popping off continually.

Cover steam pipes.

Do not waste steam through leaky valves or traps.

Never use live steam if exhaust steam is available and can be used as well.

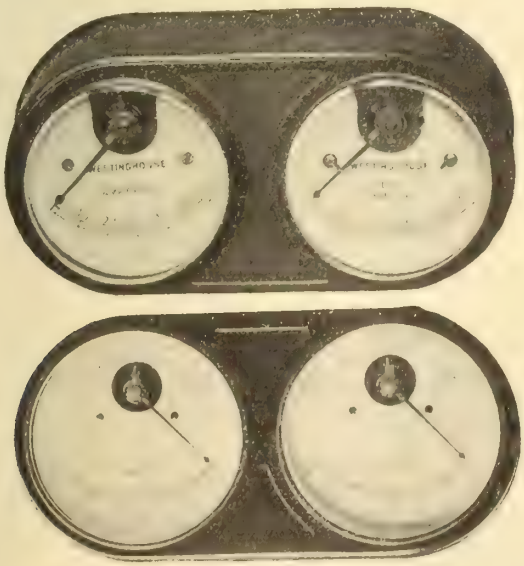
An observance of the foregoing simple rules and suggestions should materially reduce the coal consumption of the average plant.



In this unique drawing, Mr. W. L. Goodwin illustrates the analogy between the different parts of a Wheatstone Bridge and the various elements in the electrical industry. There must be a proper "balance" between the manufacturer, wholesaler, central station and retailer. The public is the "battery" which furnishes life to the whole combination. If any one part of the instrument fails to perform its proper function results are unsatisfactory all round.

New Duplex Instruments

In its new catalogue on Instruments and Relays, just published, the Westinghouse Company announces two new duplex instruments for battery charging, marine, dental, telegraph, telephone, farm lighting, and other compact instrument panels where direct-current is involved. These duplex



instruments consist of any two standard type AW or type FW instruments desired, mounted in an attractive dull-black metal case. The type AW instruments have round open faces, three inches diameter, with glass cover and rear mounting studs; the type FW have five-inch faces.

A Protection Against Reversed Phases

If a three-phase motor is disconnected from a circuit and the phases reversed when it is reconnected, it will, naturally, run backward. Such a reversal may occur and has occurred when the motor is disconnected for repairs, through an error in reconnecting leads at the power house, or sub-station, or from a number of other causes. In many cases the reversal of rotation of a motor, aside from the inconvenience it causes, is not a serious matter as the error can be corrected at the

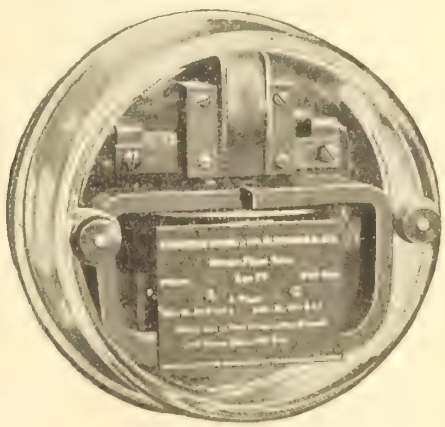


Illustration of relay.

motor terminals. In other cases, however, serious consequences may result. The reversal of an elevator motor, for instance, might result in wrecking the machinery and loss of life. To protect motors against phase reverse where such protection is necessary, the Westinghouse Electric & Mfg. Co., have developed a reverse-phase relay with very positive

and dependable operating characteristics. If a phase is reversed, or if a phase fails, or if the voltage drops below 75 per cent. of normal, the relay contacts close and trip the circuit-breaker, either through a shunt-trip coil or by short-circuiting an under-voltage trip coil having a series reverse current. The relay operates on the induction principle. When properly connected the torque holds the contacts open

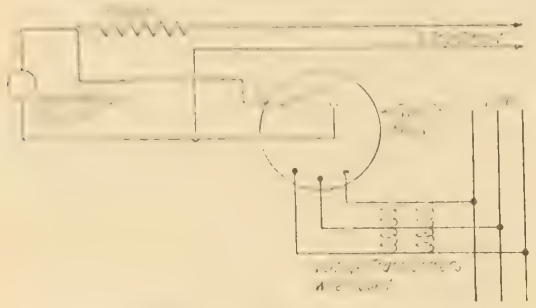
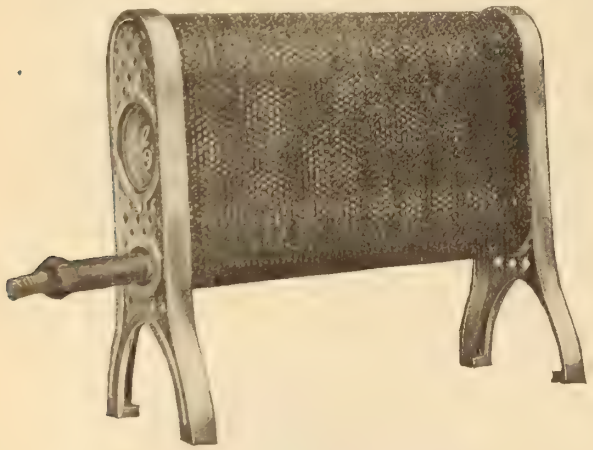


Diagram of relay connections.

against the restraint of a spiral spring. On low voltage the torque diminishes and the spring closes the contacts. On reversal of phase connections the reversed torque assists the spring in closing the contacts. The contacts will close 5 amperes at 250 volts or less.

660 and 1000 Watt Heaters

In view of the fuel situation there will probably be a general demand for electric air heaters this fall, and the Canadian General Electric Company offer the heater shown in the illustration. These heaters are built with a capacity of either 660 watts or 1000 watts, either nickel plated or with



Japan case. While they are intended principally for the early fall or the late spring days they will go a long way towards helping out the heating system on extremely cold days. They are built for service; are strong, durable and neatly designed.

The Bell Telephone Co. have filed with the Board of Railway Commissioners a new schedule of night rates for long distance calls. Between the hours of 6 a.m. and 8.30 p.m. the present day rates will apply, from 8.30 to 11.30 the rate will be 60 per cent. of the day rate, and from 11.30 p.m. to 6 a.m. 40 per cent. of the day rate.

Both the gross earnings and surplus of the Montreal Light, Heat & Power Co. continue to increase. For Aug. the gain in gross was $61,045 and in the surplus of $19,208. For the four months of the financial year the gross earnings increased $328,207, and the surplus $87,177.

Annual Convention of Illuminating Engineers

The Illuminating Engineering Society will hold its annual convention at the Engineering Societies Building, New York on Oct. 10, 1918. War-time lighting economies, the use of better lighting in speeding up war production and manufactures, the lighting of camps, effect of lighting curtailment on crime, and automobile headlight laws will be discussed.

Quebec Railway, Light and Power Co.

For the year ended June 30 last, the gross income of the Quebec Railway, Light & Power Co., was $2,027,940, a decrease of $34,943. Operating and maintenance charges totalled $1,235,724, an increase of $79,755, but fixed charges and taxes were less by $9,418. After writing off $26,789, the net surplus is $68,518, a decline of $43,152. The total surplus now stands at $753,090. The company expended $243,225 on maintenance account, which was charged to operation, in order to maintain in a high state of efficiency the physical condition of the properties and plant of the company and its various subsidiary companies.

Hydro Power for Unionville

The ratepayers of Unionville, Ont., recently passed a by-law authorizing the expenditure of $10,000 for the purpose of bringing in Hydro power. Work will be commenced in the near future. Following the installation of Hydro power in this place it is expected that the village of Markham will receive power by the same route instead of via Malvern, as was contemplated.

B.C. Association votes to join National

The British Columbia Association of Electrical Contractors and Dealers, at their last meeting, unanimously voted to associate themselves with the National Association of Electrical Contractors of the United States.

Eugene F. Phillips Electrical Works, Ltd., Montreal, have received an order from the Ontario Hydro Electric Commission for 9,000 feet of 350,000 c.m. 3 conductor 12,000 v. paper insulated lead covered double steel tape armoured cable.

W. J. Egan, Canadian Trade Commissioner, Cape Town, South Africa, states that there is an urgent need for electrical supplies in that country—particularly material for telephone and telegraph systems.

Condulets—The Crouse-Hinds Company of Canada are distributing a little folder, "Safety First Switch Condulets," describing the MK series, 30 to 200 amperes, fused, iron-clad and fool-proof.

In the United States there are three cities in which the electric railway fare is 10 cents ; one city pays 8 cents; 43 pay 7 cents and 85 pay 6 cents.

The Canadian Westinghouse Company have opened a repair department and service branch at 16 Temperance Street, Toronto.

McDonald & Willson, Limited, electric dealers, have moved from 12 Queen Street East, Toronto, to 349 Yonge Street.

Porcelain Enameled Reflectors

For Every Class of Industrial Illumination

ABOLITES



Shade Holder, Bowl Type Abolite



Holder Socket, Dome Type Abolite



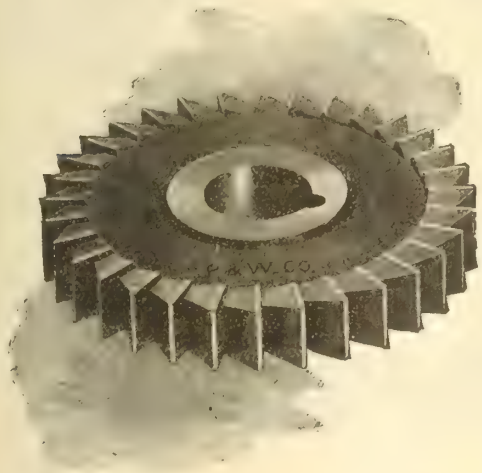
Holder Socket, Diagonal Type Abolite

INDUSTRIAL ABOLITES have gained wide adoption throughout the offices, factories, and plants of the Dominion. By their uniformity and correctness of design and construction, they are dependable as a means to lighting efficiency. The holder sockets are thoroughly ventilated with best heat radiation. Readily installed, the cost of maintaining them bright and efficient is a minimum.

In bowl, dome, diagonal, enameled holder-socket, boulevard and street front types. This excellent line of Reflectors is complete, furnishing a design for every lighting requirement. It is a safe line to buy and a quick one to sell.

THE ADAMS-BAGNALL ELECTRIC CO., CLEVELAND, OHIO

R. E. T. PRINGLE, LTD., 95 King St. E. TORONTO 703 Confederation Life Bldg. WINNIPEG 406 Vancouver Bldg. VANCOUVER, B.C. 401 New Birks Bldg. MONTREAL



Milling Cutters

Taps **Dies**
Reamers **Drills**

A Line that is Made in Canada
Guaranteed and Sold on Merit.

Pratt & Whitney Co. of Canada, Limited

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723 Drummond Bldg.

Winnipeg
1205 McArthur Bldg.

Vancouver
609 Bank of Ottawa Bldg.

Current News and Notes

Brantford, Ont.

The Brantford, Ont., hydro-electric commission have decided upon the installation of nitrogen lamps for the down-town street lighting, replacing the carbon lamps which for maintenance and renewal have been found too expensive. The city of Winnipeg has offered to purchase the old lights.

Campbellford, Ont.

The Hydro-electric Power Commission of Ontario are preparing plans for the construction of a hydro-electric plant at Rainey's Falls on the Trent River. At this point there is a possible capacity of eight to ten thousand horsepower.

Galt, Ont.

Alterations are being made to the Galt hydro-electric substation in order that current may be received at 13,200 volts instead of 6,600, as formerly.

Gilbert Plains, Man.

A meeting of the ratepayers of Gilbert Plains, Man., was held recently to discuss the possibility of installing a municipally owned electric lighting plant. Particulars and estimates are being asked for.

Hamilton, Ont.

It is stated that the Hamilton, Ont., public have taken very kindly to the p.a.y.e. system which will shortly be installed on all cars. The railway company hopes for an increase in revenue and a decrease in accidents.

Kingston, Ont.

Employees of the Kingston, Portsmouth & Cataraqui Railway Company, Kingston, Ont., have been voluntarily granted a wage increase of 25 cents a day. Eleven conductorettes are included.

St. John, N.B.

The city council of St. John, N.B., have resolved to investigate the possibilities of the Mispec Stream with a view to power development.

Smiths Falls, Ont.

Hydro energy from Merrickville was recently turned on in the Smiths Falls system. The two local plants are being overhauled and will take care of the load in supplying several big industries.

Toronto, Ont.

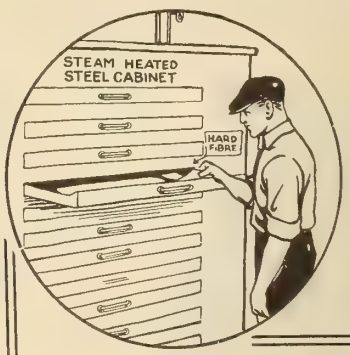
The Toronto and Niagara Power Company has made application for the right to construct another cable line from their power house on Davenport Road, along the C. P. R. right-of-way to a point where it will be convenient to branch off into York township and to the town of Leaside. The reason given is that the munition company at Leaside is in urgent need of power.

Winnipeg, Man.

The Peerless Sales and Construction Company, Winnipeg, Man., dealers in electrical goods, have been incorporated.

Northern Aluminum Co., Ltd.
1305 Traders Bank Building
TORONTO, ONT.
Manufacturers of Aluminum
Ingot, Sheet, Tubing, Wire, Rod, Rivets, Moulding, Extruded Shapes, also Electrical Conductors all Aluminum and Steel Reinforced
Litot Aluminum Solders and Flux
will solder aluminum to itself or other metals
WRITE FOR INFORMATION

ALLEN FLUX
ALLEN NON ACID SODERING FLUX
A form for every use—stick, paste, liquid or salts. Also a flux for ALUMINUM—the only one.
Only fluxes approved by National Board of Fire Underwriters.
Given the preference by America's greatest electrical and industrial corporations.
Samples free.
BISSETT & WEBB
126 Lombard Winnipeg, Man., Canada
at it since '93



Give It the Heat Test

Spaulding HARD FIBRE

Put a sheet, rod or tube of Spaulding Hard Fibre in a dryer or hang a piece of it in a hot place. You'll be convinced that it will not dry out, become brittle, nor lose its toughness when used near heat.

A 100% material for many purposes

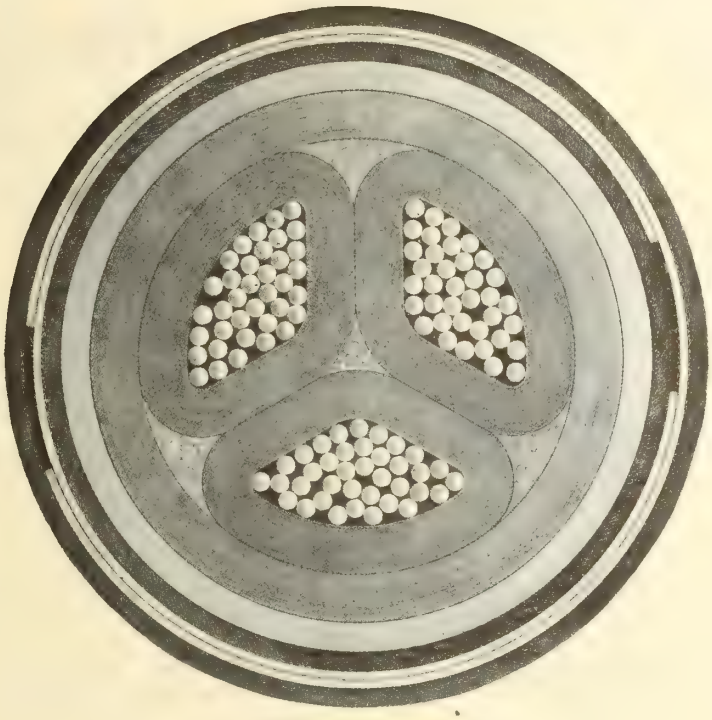
Its electro rupture is 200-400 volts per 1/1000 inch of thickness; tensile strength 10,000-20,000 lbs. per square inch; compressing point, 38,000-42,000 lbs. per square inch; shearing strength 9,000-13,000 lbs. per square inch. It can be machined, sawed, stamped, bent, threaded, drilled and finished in many attractive ways.

Made in red, black and grey colors. Send for samples. Our Specialty Department is equipped to machine special parts to your own specification.

J. SPAULDING & SONS CO., Tonawanda, N. Y.

449 Broom Street, New York City. **Suburb of Buffalo** 166 Clinton Street, Chicago, Ill.

POWER CABLE



350,000 C.M. 3-Conductor 12000 volt
Paper Insulated, Steel Tape Armoured Cable

Overall Diameter—3.62 ins.

Built to Specifications of Hydro-Electric Power Commission of Ontario

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Eugene F. Phillips Electrical Works, Limited
MONTREAL

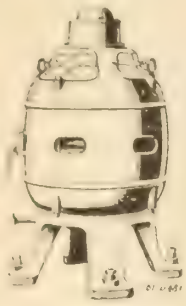
Branches: Toronto, Winnipeg, Regina, Calgary, Vancouver

Do Not Guess



Know that your motors are dependable. There is one sure way. Buy

Wagner Quality



Motors

Remember "The Proof of the Pudding"—consult the man who owns or runs a Wagner Motor. His experience will eliminate any doubt in your mind.

Then send for Bulletins 11013 and 11113.

Wagner Electric Manufacturing Company
of Canada Limited-Montreal

Power Bldg., Montreal. 347 Adelaide St. W., Toronto
518

If a Brush Absolutely Refuses To Spark!

is that not a very good reason for fitting it on your motor generators and commutators?

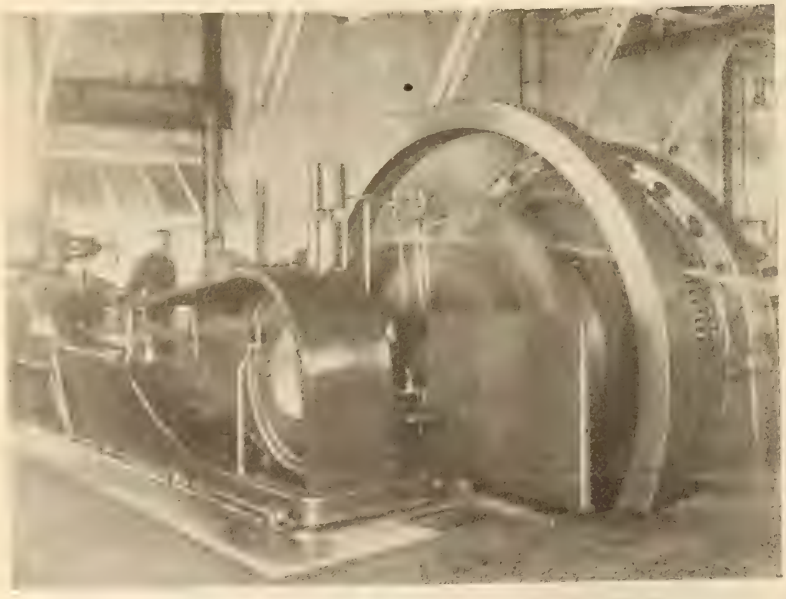
No-Spark Carbon Brushes

wear longer because they are frictionless and self-lubricating. The remarkable economy of these brushes will appeal to you. They have often outlasted the ordinary brushes 8 to 12 times over.

Write for our latest bulletin.

CALEBAUGH
Self-Lubricating Carbon Co.
1503 Columbia Ave., PHILADELPHIA, Pa.

25 Cycle Engine Generator Sets For Sale



These units were in use only—300 K.W. three months, and 250 K.W. seven months, and are in first class condition.

1—250 KW.
1—300 KW.

25 Cycle, 3 Phase, Westinghouse Generators, Direct Connected to McIntosh & Seymour Cross Compound Gridiron Valve Engines, 150 R.P.M.

1—60 K.W., 60 Cycle, 3 Phase, 2300 Volt Generator

1—100 K.W., 25 Cycle, Motor Generator Set

1—100 K.W. Direct Current Engine Generator Set

1—12 x 24 x 30 Wheelock Tandem Compound Engine

Write for further particulars and quotations

Power Plant Equipment Co., Dominion Bank Bldg. Toronto, Ont.

LINCOLN MOTORS

Lincoln Arc Welders

SAVE 50%

You can save 50% — very often more—by doing your boiler plate work with a Lincoln Arc Welder instead of rivetting it.

Lincoln-welded joints are 100% strong — rivetted joints are no stronger than the rivets themselves.

The Lincoln Arc Welder avoids awkward overlapping on corners, thus saving time.

Its heat is greater, more concentrated, and more readily controlled than that of any gas or other welding system, and the current is all usefully employed—there are no "ballast resistances" to waste 50% to 80% of the power taken.

It has been adopted by boiler shops, structural steel works, street car and railroad companies as being the most practical solution of the present labor shortage.

Lincoln Electric Co.

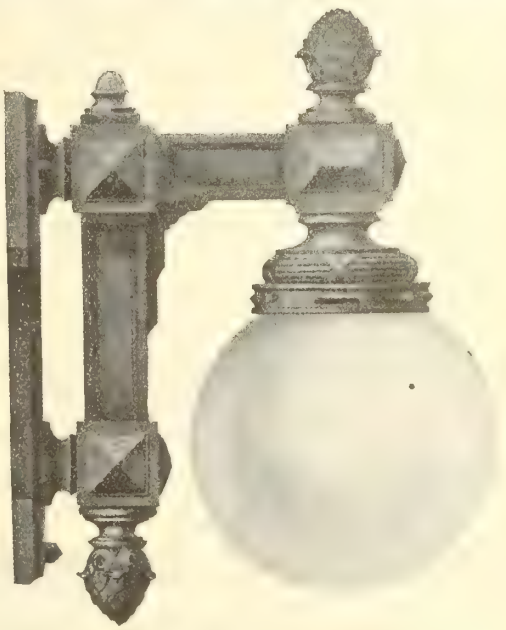
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FOR EVERY PURPOSE
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Bronze or Cast Iron Brackets
for
Outside Lighting

Tallman Brass & Metal Limited
HAMILTON, ONT.

Canada Wire & Cable Co., Limited

Head Office and Works, TORONTO

Bare and Insulated Electrical Wires for all purposes

Electric Railway Trolley Wire and Feeder Cable

Sales Offices and Branch Warehouses:
501 Merchants Bank Building, MONTREAL
592 Notre Dame Avenue, WINNIPEG
674 Barrington St., HALIFAX.
W. H. Hazlitt & Co., Ltd., 915 Georgia St. West, VANCOUVER

Prompt shipments from Factory or nearest Warehouse

For Sale

[illegible] K.W. Westinghouse Generator [illegible] Syn. Motor, 3 phase, 60 cycle, 2200 r.p.m., [illegible] Voltage, 562000

CHARLES E. LEACOCK,
12-22 107 Duke St., Toronto

POSITIONS VACANT

Wanted: Experienced man, returned soldier preferred, to act as Meter Reader and Inspector. Apply, stating experience, to Smiths Falls Hydro-Electric System. 12 t.f.

WANTED

Technically educated man, one not subject to Military Draft, as Mechanical Superintendent of a large public service corporation operating both Gas and Electricity, must have thorough knowledge of the manufacture of Transformers, Gas Meters, Electric Switches, Fuses, and Electric Line material; be experienced in the maintenance of the above as well as Hydraulic Turbine, Steam Turbine and Reciprocating Engine Equipment of various kinds; must also have experience on the operating and maintenance of a fleet of Motor Vehicles, both Electric and Gasoline, and a knowledge of maintenance of Edison Batteries. Apply, giving experience and references, through this journal. Box 788 Electrical News, Toronto, Ont. 19

Chaufferless Utility Vehicles

By A. Jackson Marshall

Heretofore, anyone with sufficient money and a desire for a motor car with a chauffeur, and perhaps also a "footman," or lackey, could, and did, quickly gratify such wish. Most anything of a material nature could be had for money. Today, conditions are different—they will become more so as the war advances. Hundreds of thousands of men have been called to war. Millions—a much greater quantity than is generally realized in these days of huge figures—will follow. Ere long, men will seem as scarce as four leaf clovers. Men remaining will be engaged in serious and important war operations. Few men will be available for driving passenger cars, especially if their particular application consigns them to the "pleasure" class. The "two-men-on-the-box" exposition of wealth will be in the extinct class of the Dodo. The rapidly expanding use of the motor truck as an important link in the transportation chain, which daily becomes more vital to our success in war, makes increasing demands for chauffeurs. This ever-increasing demand, which must, and will be, met, will make further inroads on available chauffeur supply. The gasoline car chauffeur will be needed in great quantities for the driving of army trucks, tanks, aeroplanes, etc. This work is of cardinal importance, and the demand must, of necessity, be met. The ultimate result—already becoming evident—will be that gasoline passenger car owners—real and prospective—will drive their own cars, lay them up and do without them, or, if they ride, use electric vehicles, which they may readily operate with safety and comfort with little coaching.

But this chauffeur situation does not stop with driving—cars must be kept in running condition, and here again the "electric" is favored, for its design and construction is the personification of simplicity, there being but one moving part in the motor—the armature, and that revolves.

PETRIE'S LIST

of New and Used

MOTORS

FOR IMMEDIATE DELIVERY

No.	H.P.	Phase	Cycle	Volts	Speed	Maker
1	100	3	25	550	480	Westg.
1	40	3	25	550	750	C. G. E.
1	30	2	60	220	1500	T. & H.
1	25	2	60	220	945	Westg.
1	25	3	60	2000	900	C. G. E.
1	20	3	25	550	1440	J. & M.
2	10	3	25	550	720	Westg.
1	7½	3	25	550	750	C. G. E.
3	5	3	25	550	720	Westg.
5	4	3	25	550	1400	Excelsior
2	3	3	25	550	1500	C. G. E.
3	3	3	25	550	1400	Excelsior
1	1	3	25	550	1400	Excelsior
1	¼	1	60	110	3400	Diehl.
1	¼	3	25	550	1500	T. & H.

Write Us for Prices

H. W. PETRIE, Limited

Front St. West - Toronto, Ont.



Rubber Covered Wires and Cables

FOR POWER, LIGHT AND TELEPHONE WORK

Incandescent Lamp Cord, Flexible Switchboard Cables, Special Cords and Cables for all kinds of Electrical Work.

Prompt Shipments from Canadian Factory.

BOSTON INSULATED WIRE & CABLE CO., Limited

Canadian Office and Factory, HAMILTON, ONT.

FOR SALE

1—50 H.P. 3 Phase, 25 Cycle, 2,200 Volt, 750 R. P. M. Canadian General Electric Motor. Complete with pulley, rail-base and oil immersed auto-starter equipped with "No Voltage" release; also 1, 30 ampere, 2,500 volt. Oil switch equipped with "Overload" trip and one potential transformer. Immediate delivery.

The FISHER ELECTRIC CO.

43 Britain Street, TORONTO

Tenders

A few dollars spent in advertising your proposals in

The Contract Record

would result in additional competition, which might save your city or town or your client many hundreds of dollars.

Motors, Generators, Transformers

New and Used for Immediate Delivery

MOTORS

25 cycle, 3 phase

No.	H.P.	Volt	Speed	Make
1	125	2200	500	C.G.E.
1	100	550	720	Westg.
1	75	550	500	Westg.
1	50	550	720	Westg.
1	40	550	720	Westg.
1	25	550	720	C. G. E.
1	15	550	720	C. G. E.
1	10	550	720	C. G. E.
1	125	220/440	375	Westg.
1	100	220/440	500	Westg.
1	75	220/440	500	Westg.
1	50	220/440	500	Westg.
1	30	220/440	500	Westg.
1	20	220/440	500	Westg.

60 Cycle, 3 Phase

No.	H.P.	Volt	Speed	Make
1	200	2200	600	Westg.
1	150	2200	600	C. G. E.
1	100	2200	600	C. G. E.
1	75	550	900	C. G. E.
1	50	550	900	C. G. E.
1	30	550	900	C. G. E.
1	40	220	900	Westg.
1	20	220	1200	C. G. E.

GENERATORS

60 Cycle, 3 Phase

No.	K.V.A.	Volt	Speed	Make
1	600	2200	225	C. G. E.
1	300	2200	600	A. C. B.
1	150	2200	600	C. G. E.
1	125	240	900	C. G. E.
1	75	240	900	C. G. E.
1	75	2200	900	Westg.
1	50	550	1200	C. G. E.

Direct Current

No.	K.W.	Volt	Speed	Make
1	500	250	300	Westg.
1	300	250	300	Westg.
1	150	250	500	C. G. E.
1	85	250	750	Westg.
1	35	250	300	C. G. E.
2	20	125	500	Westg.
1	17	125	1100	Westg.
1	12	125	1100	Westg.
1	7½	125	1100	Westg.
1	5	125	1200	C. G. E.
1	40	125	300	Westg.
	(Direct connected to engine)			
1	150	110/220	500	C. G. E.
	(Direct connected to engine)			

TRANSFORMERS

25 Cycle, S.P.

No.	K.V.A.	Volt
3	100	13200-6600/2200
3	125	26000-13000/2200-600

60 Cycle, S.P.

No.	K.V.A.	Volt
2	60	10000-2200
2	75	2200-110/220
2	50	2200-110/220
2	40	2200-110/220
2	10	2200-550
2	10	2200-110/220

NOTICE

If you have any Motors, Generators, Transformers, etc., any capacity, for sale, send full particulars to us for prompt disposal.

DIRECT CONNECTED SETS

2—450 K.V.A., 25 cycle, 550 volt, 3 phase, Westinghouse Generator, direct connected to Cross Compound Engines. Complete with switchboards, exciters, condensers, etc.
1—250 K.V.A., 25 cycle, 2200 volt, 3 phase, Westinghouse Generator, direct connected to Cross Compound Engine. Complete equipment.
1—5 H.P., 25 cycle, 550 volt, 3 phase, 1500 R.P.M., Lincoln motor, direct connected to 5 K.W., 125 volt, direct current generator.

Write or wire for full particulars and send list of equipment for sale.

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3 Phase, 60 and 25 Cycles

3 PHASE, 60 CYCLE MOTORS

Qu.	H.P.	Make	Volts	Type	Speed
	¼	R&M NEW.	110		1700
	½	G.E. NEW..	110	KT	1800
	½	G.E.	110	I	1800
1		G.E.	220	KT	1800
1	1½	Wstgh. . . .	220	CSA	1725
3		Cr Wh. . . .	220		1720
5		G.E. NEW. no starter slip ring	220	MT	1800
5		Cr. Wh. . . .	220	Q	1720
5		C. Wh. . . .	550	Q	1720
5		Wstgh. NEW	220	CS	1130
5		Wstgh	220	CCL	1700
5		Wstgh. NEW	220	CS	1735
5		G.E.	440	KT	1200
7		G.E.—motors only	550		1200
		New Fbks. M. resistance starters starters for above)			
7½-15		Cr. Wh..	220		865/1735
7½		G.E. NEW..	220	KT	900
10		G.E.	220	L	1200
10		G.E. NEW..	220	KT	1200
10		G.E. NEW.. slip ring— no starter .	220	MT	1800
10		R&M	220	K	1750
7½		G.E. NEW..	220	KT	1800
7½		G.E., motors only	550	KT	1800
		(New Fairbanks-Morse resistance for above)			
10		Wstgh. . . .	220	CCL	1700
10		Wstgh. . . .	220	CS	1150
10		Wstgh. NEW	220	CS	1150
10		Burke	220		1200
10		Cr. Wh. with resistance type starter.	550	Q	1800
15		G.E. NEW..	220	KT	900
15		Wstgh. NEW	220	CS	1155
15		G.E.	220	I	900
1	15	Wstgh. . . .	220		1165
1	15	Wstgh. NEW	220	CS	860
1	20	Wstgh. NEW	220	CS	860
2	20	Wstgh. . . .	220	CS	1160
1	20	G.E.—Special feet- no starter . . .	220	M	900
42	80	Fbks. M.	220/440	KBV	1200
1	20	G.E.—slip ring, intermittent duty—no controller .	220	IM	900
		Controller with grids for above			
3	25	Wstgh. NEW	220	CS	865
9	25	Wagner .	220/440	BP	1120
2	30	Wagner New	220		850
1	35	Triumph.	220/440		900
1	40	Fbks. M. .	220		900
1	50	Triumph . .	220		720
1	50	Allis-Chal. . .	220		1750
1	50	Wstgh. NEW	440	CS	860
1	75	Wstgh. NEW	440	CS	720
1	100	Allis-Chal. ..	550		600
1	100	G.E.	550	K	600
1	100	G.E. NEW .	550	M	600
1	150	G.E. NEW .	220	M	580

3 PHASE, 25 CYCLE MOTORS

5	5	G.E.	220	KT	1500
1	5	Wstgh. . . .	220	CCL	1420
2	5	Wstgh. .. .	220	CCL	705
15	15	Allis-Ch. . .	220		750
2	25	G.E.	440	I	750
1	40	Wstgh. . .	220	MW	695
1	50	Allis-Ch. intermittent duty, sl. rg. drum controller	440		500
1	55	Wstgh.sl.rg. 30 cycles, complete. .	440		860
1	60-45-30	G.E.	440		500-375-250

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1	50	3	750	550	25	yes	C.G.E.
1	60	3	750	550	25	yes	Crocker Wheeler
2	50	3	750	220	25	yes	Lincoln
1	25	3	750	220	25	yes	Lincoln
1	25	3	750	220	25	yes	C. G. E.
1	15	3	1500	220	25	yes	T.H.E.
1	10	3	1500	220	25	yes	T.H.E.
2	5	3	750	550	25		Westgh. CCL.
2		½ 1	1500	110/220	25		Century & Wagner
1		½ 1	1800	110	60		Fort Wayne
1		¼ 1	1800	110	60		Westgh.
1		¼ 1	1800	110	60		Fisher
1	40	2	900	220	60	yes	Fuller Wenstrom
1	15	2	1200	220	60	yes	C.G.E.
1	10	2	variable	220	60	no	Westgh.
2	10	2	1200	220	60	yes	Westgh. CCL.
1	10	2	1800	220	60		T.H.E.
1		7½ 2	1200	220	60	yes	Crocker Wheeler
2	5	2 or 3	1800		60		Westg. CCL. rewd.
2	5	2	1200	220	60	no	Westg. C.
3	5	2	1800	220	60	no	Westg. CCL.
2	1	2 or 3	1800		60	no	Westg. CCL. rewd.
1		½ 2	1800	220	60	no	Westgh. CCL.
2	10	2 or 3	1200		60	no	Westg. CCL. rewd.
1	3	3	1200	220	60	no	Westg. CCL.
2	3	3	1800	220	60	no	C.G.E. rewound
1	20	3	900	220	60	yes	Lincoln
4	7½	3	1800	220	60	yes	Lincoln

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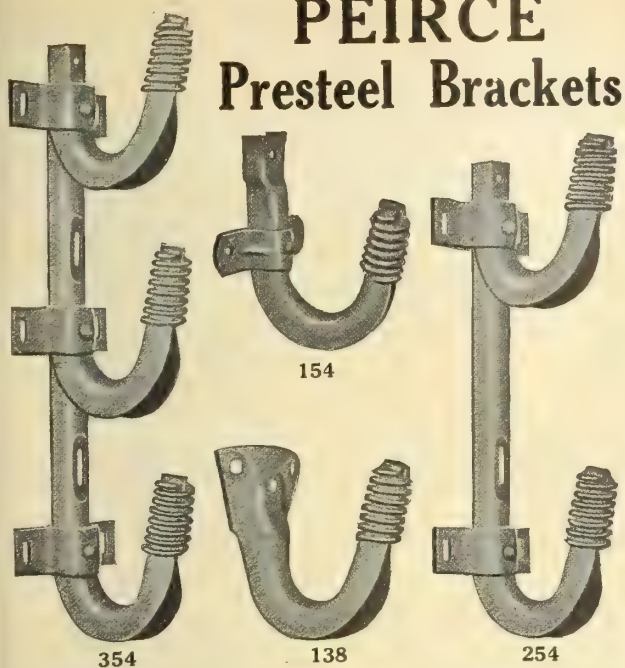
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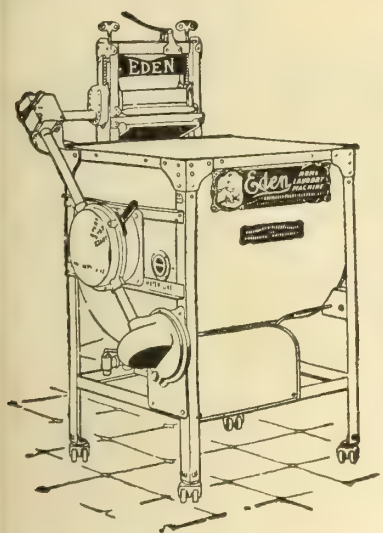


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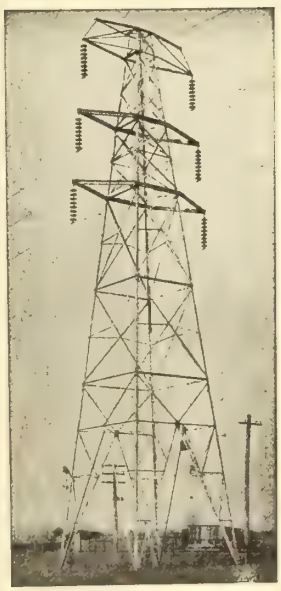
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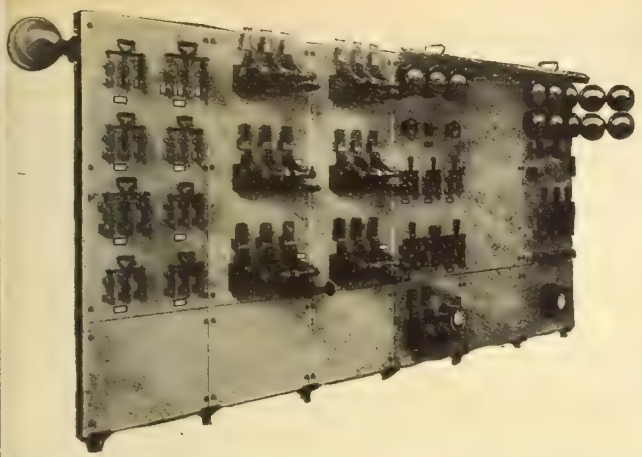
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Devoe Electric Switch Company
Northern Electric Company

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Electrical Maintenance & Repairs Company

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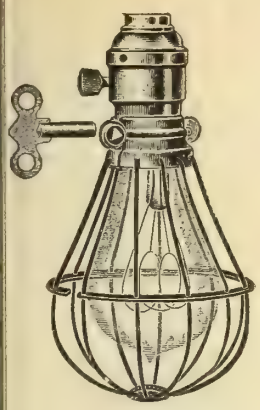
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Northern Electric Company
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(Continued on Page 56)



Safeguarding the Lamp

From Theft or Breakage LOXON Does It!

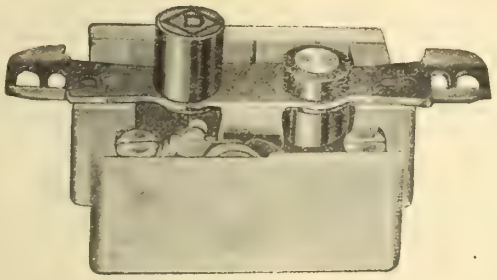
One turn of the key and the lamp can't come out. Loxon, the lamp guard, is popular all over America. It sells at a single price at a single glance.

Many other electrical specialties which will make money for you. Get in touch with us. Illustrated price lists free.

McGILL MANUFACTURING COMPANY, Valparaiso, Ind.

Approved Flush Switch

Shallow Type



Single Pole No. 200—Three Way No. 203

Underwriters' Laboratories
Chicago—File E3588

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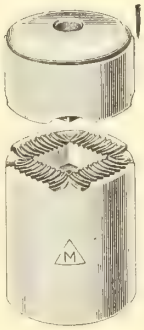
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1665 St. James St. - MONTREAL, QUE.

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Solid Knobs, Split Knobs, Cleats, Tubes, and special Porcelain of all kinds.



Strain and Screw Thread Insulators. Unsurpassed in quality and design.

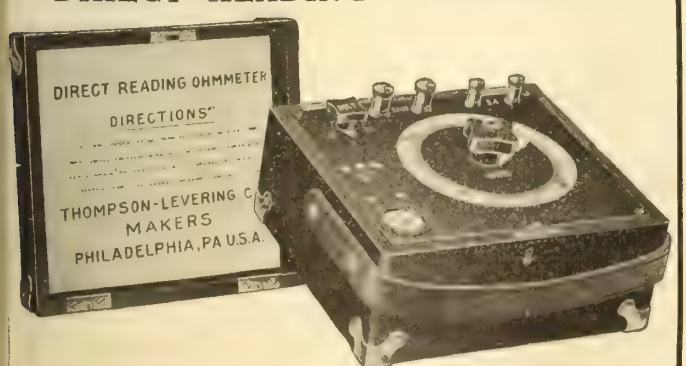
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CUT THE COST

of your pole lines by using our

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They last longer, look better, and cost less to erect than any other kind. Treated with Carbolineum or Creosote they make you a big saving. Full information without any obligation from our nearest office.

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CANADIAN PORCELAIN CO.

LIMITED

HAMILTON - CANADA

Manufacturers of High and Low Tension Porcelain Insulators

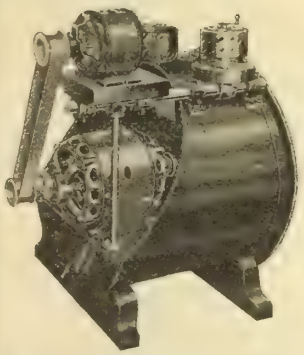
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Equipments driven by

Century

Repulsion Start Induction

SINGLE PHASE MOTORS



Illustrating a 1 hp. motor direct connected to an organ blower.

easily meet the specifications covering apparatus for installation in public buildings, churches, schools and residences.

When full speed is reached the brushes are removed from the commutator.

1/10 to 40 H. P.

CENTURY ELECTRIC COMPANY

ST. LOUIS, Mo., U.S.A.

Stock carried in Canada by: 260
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Great West Electric Co., Ltd., Winnipeg
Rudel-Belnap Machinery Co., Ltd., Can. Express Bldg., Montreal
Rankin & Cherrill, 55 Hastings St. W., Vancouver, B.C.



You Pay For Good Wire

whether you use it or not. If you buy a cheap wire whose quality is kept down to meet a price instead of up to meet a standard, you may pay several times the cost of good wire in replacement of your wiring or the building in which it is installed.

"Sterling" Rubber Insulated Wire

is kept up to a high standard of dependability and is sold at a reasonable price that makes it available for the cheaper class of buildings. It has always exceeded the requirements of the N. E. C. by a liberal margin which constitutes the purchaser's insurance against the defective wire risk.

Write our nearest office for samples and prices

Standard Underground Cable Co. of Canada, Limited

General Offices and Works—
Hamilton, Ont.

Montreal, Que. Toronto, Ont.
Hamilton, Ont. Seattle, Wash.

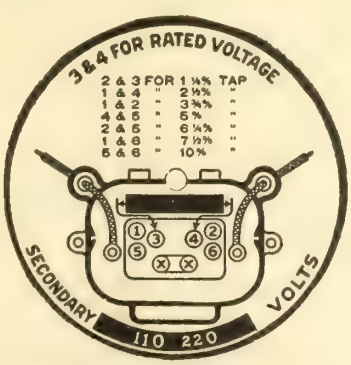
Moloney Service Transformers

are all supplied with brass plates fastened on the inside of the cover of each transformer; all connections marked plainly. They do not get covered with dirt or stained with oil like a blue print does. You always have them before you when changing taps. Heavy bushings eliminate breakages in shipment and handling

Moloney Transformers are manufactured in a factory that was built especially for that purpose only. They are designed by Engineers and built by men who make a specialty of this work.



Subway Type



Made in Canada



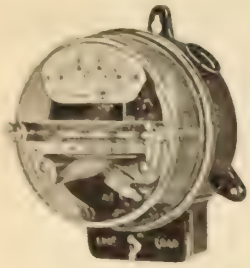
Pole Type

MOLONEY ELECTRIC COMPANY OF CANADA, LIMITED

Factory
Windsor, Ont.

Head Sales Office
Bank of Hamilton Bldg., Toronto

Branch Offices
Montreal, Halifax, Winnipeg, Vancouver

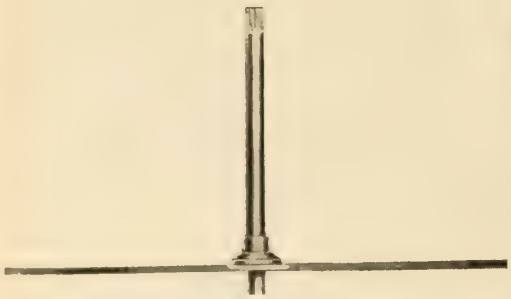


Westinghouse

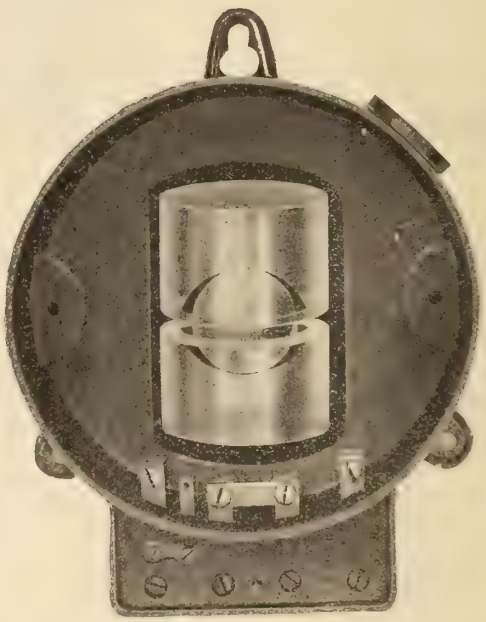
Type CC Watthour Meter



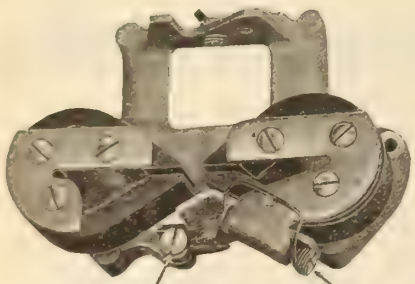








SIMPLICITY



LIGHT LOAD ADJUSTMENT

FULL LOAD ADJUSTMENT

ACCURACY



The ball bearing is the foundation on which has been built the reputation of Westinghouse Watthour meters for sustained accuracy.

SPECIAL FEATURES

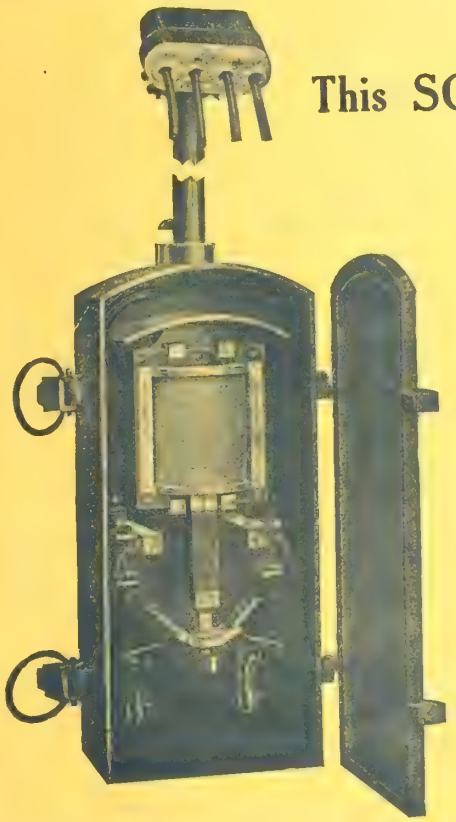
Few parts, composed of assembled units. Self-locking adjustments for full and light loads. Superior accuracy at light load and over-load.

All parts built to gauges and absolutely interchangeable.

CANADIAN WESTINGHOUSE CO., LTD.

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This SOLENOID SWITCH has been adopted by the Hydro Electric Commission

They use it for

STREET LIGHTING

Now the fact that it is used by the Hydro-Electric Commission is proof that it is all we claim for it. It certainly is not an experiment. by the fact that it is giving efficient service in many towns throughout Ontario, as well as the other provinces.

No springs, swivels or other complicated mechanisms to give trouble. They close magnetically and are opened by gravity assisted by the tension of the laminated copper contact. All arcing is taken up on the carbons.

Increase the efficiency of your system and decrease the cost of installation by using our Type 17 H.E.P. Solenoid Switches, which are suitable for any frequency on multiple circuit or D.C. Series circuit.

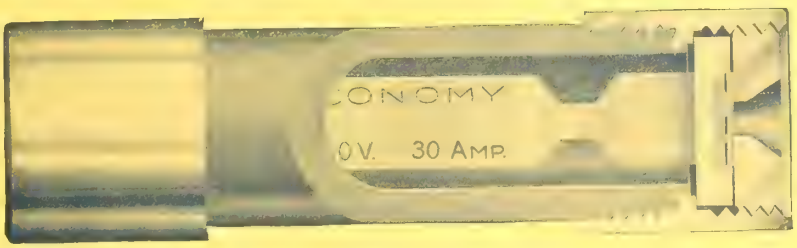
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The Electrical Maintenance & Repairs Company, Limited

Phone Adelaide 902-903

162 Adelaide Street West TORONTO

Nights Beach 1723 1930



GROWTH—

Day after day, week after week, month after month, for the five years that Economy Fuses have been on the market, the sales have maintained a constant growth—not alone in volume, but also in percentage of increase. This is because

ECONOMY Renewable FUSES

are absolutely accurate in operation and cut annual fuse maintenance costs 80%. An inexpensive little "Drop Out" Renewal Link restores a blown Economy Fuse to its original efficiency.

Write for Catalog 20

ECONOMY FUSE & MFG. CO. OF CANADA, LTD.

UNITY BUILDING - MONTREAL

Manufacturers in Canada of S.& C. High Potential Fuses—to 150,000 Volts

We have a large stock of

New and Used

Motors and Generators

FRED THOMSON CO., LIMITED

7-13 ST. GENEVIEVE STREET

MONTREAL

We extend a cordial invitation to the electrical fraternity to call upon us in our new building—the largest and best equipped electrical repair establishment in Canada.

G&W ELECTRIC SPECIALTIES

A Few Means of Reducing Distribution Costs



—Equip to handle "trouble" without costly cable or line cutting.
—Eliminate expensive "temporary" repairs.
—Install cable-end sealing devices
—Stop extended service delays.
—Make every circuit interconnecting without cable or line cutting.

The experience of every seasoned Central Station Engineer will bear out the wisdom of avoiding the "penny wise pound foolish" policy in laying out any system for electrical distribution. On the other hand, it is often easy to swing too far in the other direction—to over-spend in obtaining flexibility in switching, protection from burnouts, etc.

It is the purpose of G & W distribution specialties to obtain maximum distribution economy—it is the purpose of G & W Engineers, with over 15 years' experience behind them, to aid in their most efficient application.

Use these devices and this engineering service to overcome and reduce your distribution difficulties. Lower your distribution costs!

Have you received new Catalog No. 10? Contains Valuable illustrations and drawings for every Central Station Engineer.

G & W Electric Specialty Company

Distribution Engineers, Manufacturers of Potheads of all kinds.
Switching and Distribution Boxes, Overhead and Underground Distribution Specialties.

7440-7450 South Chicago Ave. - CHICAGO, U. S. A.

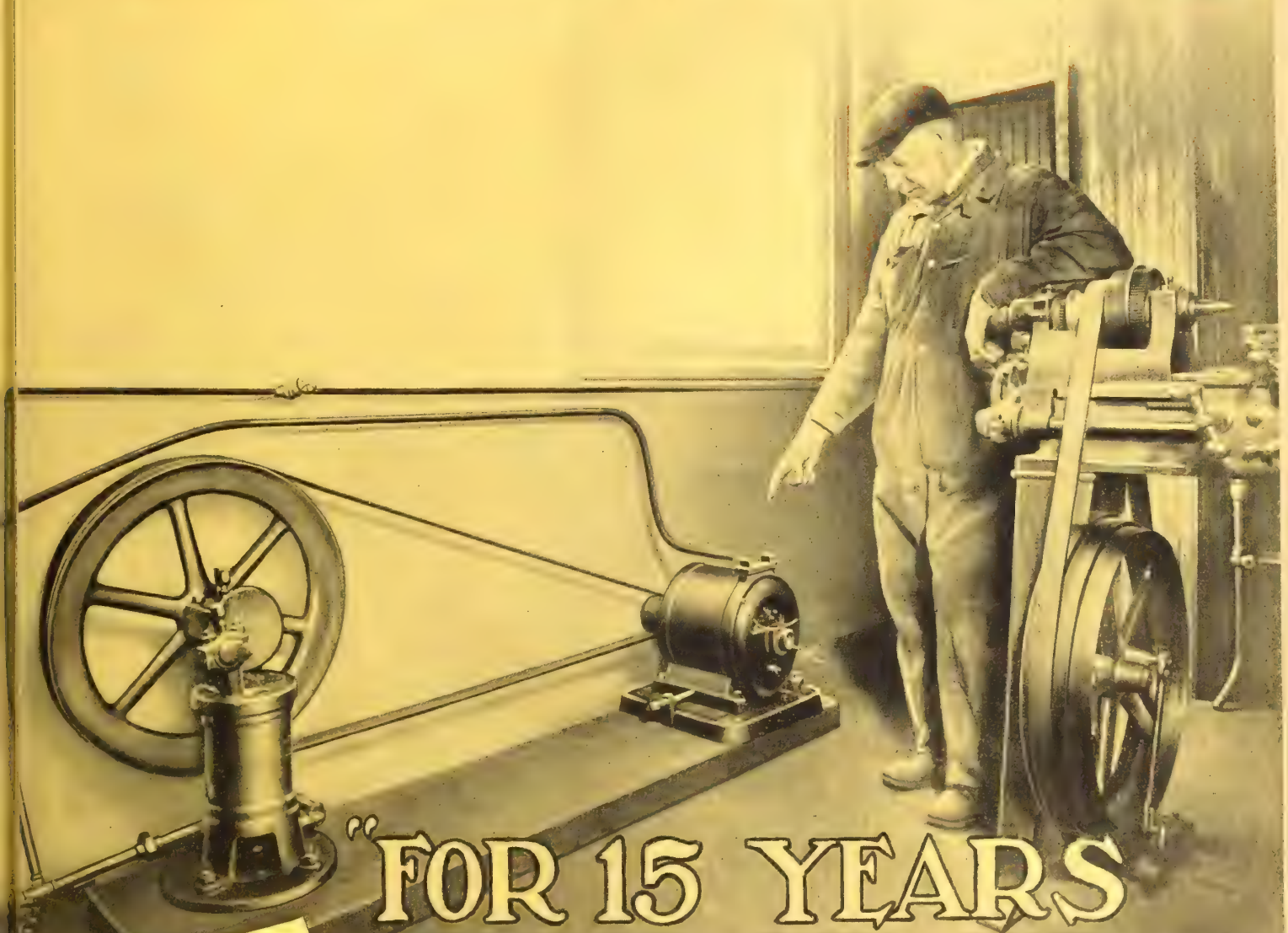
A. H. Winter Joyner, Ltd., 100 Wellington St. W., Toronto.
A. H. Winter Joyner, Ltd., 10 Cathcart Street, Montreal.

Bentz-Richardson Co., Ltd., 592 Notre Dame Ave., Winnipeg.
General Supplies, Limited, Calgary and Edmonton.

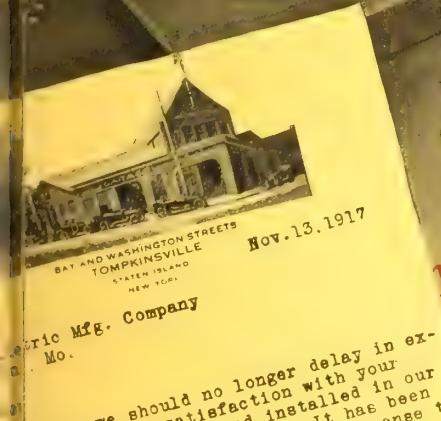
XVII No. 20 Toronto, October 15, 1918

Electrical News

Generation, Transmission and Application of Electricity



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BAY AND WASHINGTON STREETS
TOMPKINSVILLE
STATEN ISLAND
NEW YORK

Nov. 13, 1917

ric Mfg. Company
Mo.

e feel we should no longer delay in ex-
our complete satisfaction with your
otor which we have had installed in our
the past fifteen years. It has been
ical use every day at a total expense to
Of for brushes, and in all probability it
anc another fifteen years of service.

We thought you would be pleased to know
e satisfactior it has given us and the ex-
ly economical cost of its operation. It
give us pleasure to tell how well pleased
to anyone you may refer to us at any time.

truly yours,
AN AUTO CO. Inc.

Wagner Quality

That Means Satisfaction

Satisfied to the extent of recommending the purchase of Wagner Quality Products to others. Please note this is not simply the OPINION of this customer, it is fact founded on the great teacher EXPERIENCE. Reliability, continuity of service, dependability, freedom from trouble or repairs—call it what you will—it is the most important factor TO YOU in the purchase of electrical apparatus.

Let us send you our handsomely illustrated Bulletin 11513, "Motor Applications."

Wagner Electric Manufacturing Company
of Canada Limited - Montreal

Northern Electric

"DUMORE" UTILITY MOTORS



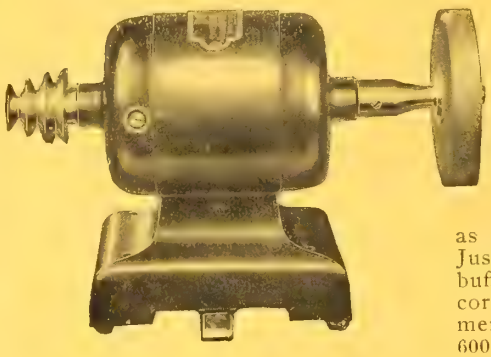
are a boon to Housewives, and go a long way towards helping solve the servant problem by furnishing sufficient power to do light chores. "DUMORE" Utility Motors are small in size but capable of long, hard service in driving many domestic appliances, or with attachments for polishing silverware, cleaning cutlery, sharpening knives, etc., etc.

TYPE "A" 1 25 H.P.

Built to meet the demand for a light, compact power unit. Finished in black enamel. Equipped with 3 ft. of cord and attachment plug, wheel arbor and emery wheel. Wheel arbor nickel plated. Speed 3000 to 9000 R.P.M.

TYPE "B" 1/25 H.P.

The Type B Motor is the same as the Type A illustrated above, excepting that it is finished in all nickel plate. Equipped with 3 ft. of cord and attachment plug Makes a very attractive looking motor for any use.



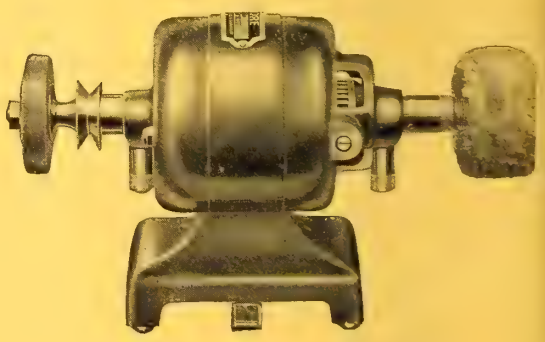
TYPE "C" 1/16 H.P.

Light and powerful. Always ready for use, and is as near trouble proof as it is possible to make a motor. Equipped regularly with 3-step pulley on one end of the motor shaft and a wheel arbor on the other, together with emery wheel. The Type "C" can be equipped the same as the Type "D" motor if so ordered. Just the motor for light polishing and buffing work. Equipped with 8 ft. of cord and attachment plug. Cutler-Hammer 3-speed Rheostat. Speeds 2000-6000-8000 R.P.M.

Practical—Efficient—Economical

For Jewelers, Dentists, Hotels and Restaurants the "DUMORE" Utility Motor will be found indispensable in a great many ways. Furnished in three sizes —"A"—1/25 H.P.; "C"—1/16 H.P., and "D"—⅛ H.P. For the benefit of the trade we have undertaken to advertise these famous "DUMORE" small motors to the public through the Daily Papers from coast to coast, and it will be to your distinct advantage to carry this line in stock for demonstration when called upon to do so.

For full particulars, prices and attractive literature, write our nearest house



TYPE "D" 1/8 H.P.

The Type "D" Motor is one of the most popular of stock sizes. Is especially adapted for jewelers' and dentists' work. Equipped with 8 ft. cord and attachment plug. Cutler-Hammer 3-speed Rheostat in the base. Shaft ends are tapered. Ritter chucks and wheel arbors can be used on this motor. Speeds 2000-6000-8000 R.P.M.

Northern Electric Company

LIMITED

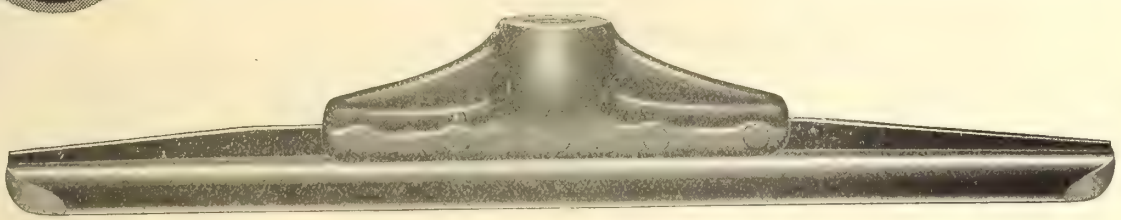
MONTREAL
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OTTAWA

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VANCOUVER

O-B PRODUCTS

Quality First



O-B Extruded Ear (Runner piece extruded metal. Malleable boss clinched and riveted on.)



On Round Wire Generous Amount of Metal in Lips



On Grooved Wire Perfect Wheel Clearance



On Figure 8 Wire Perfect Wheel Clearance

O-B Extruded Ears Will Save for You

There are five big reasons for putting O-B Extruded Ears on the trolley—denseness, toughness, ductility, accurate dimensions, uniformity.

All of these are natural consequences of the extrusion process which consists of forcing red-hot (not molten) brass through a die under tremendous pressure.

Because O-B Extruded Ears are so dense and tough they resist wear remarkably.

Because they are ductile and accurate in dimensions they fit the wire tightly and smoothly. So arcing is reduced materially.

Because they are uniform you can be certain that the long life you get from your trial installation is a true index of the saving you can make on the entire road.

Here is the surest, fairest way to find out what O-B Extruded Ears will save you — stagger them on the line with other ears and keep tabs on results. Write us about it.

The Ohio Brass Company, Mansfield, Ohio

"FLEXTUBE"

FLEXTUBE

The only parts of a coil you have to throw away are the identifying red, white and blue tie ribbons. FLEX-TUBE samples and descriptive Bulletin No. 151 sent on request.

National Metal Molding Co.

Manufacturers of

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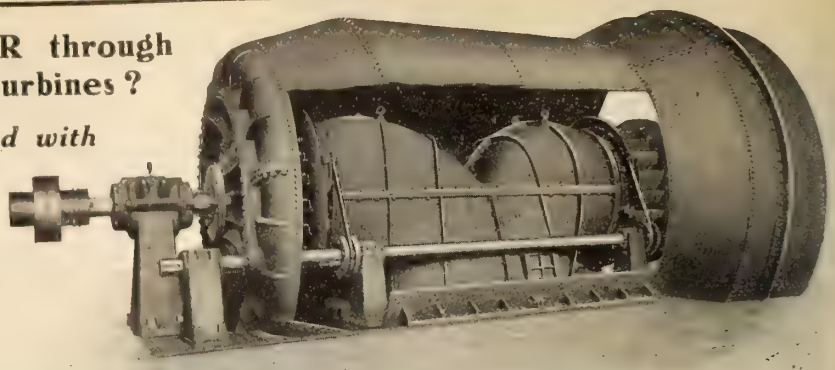
THE BLACK DOTTED LINE
IS THE MARK OF
DURADUCT

ARE YOU WASTING POWER through Inefficient and Antiquated Turbines?

Maximum Efficiency Assured with

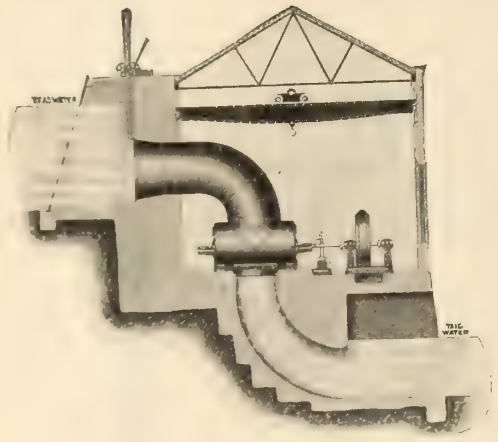
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HYDRAULIC TURBINES

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S. MORGAN SMITH CO.
YORK, PA.
H. B. Van Every, 405 Power Bldg., Montreal

Hydraulic Turbines



Send for our Bulletin No. 54

Wm. Hamilton Co., Limited
Peterboro, Ontario

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The Standard Mica Insulation

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Cloth
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Heater Plates
Flexible Plates
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Mica Insulation for Moulding and Commutator Segments

THERE is a special Micabond insulation prepared for every electrical condition.

Micabond insulations possess unusual wearing qualities and are reasonable in price.

Send us your B/P's or samples and let us figure your motor requirements.

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"The material of a thousand uses"

THE ANHYDROUS PHENOL RESIN COMPOUNDS

They excel in
Heat Resistance—Dielectric Strength—Mechanical Strength—Accuracy of Dimensions
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sheets, tubes, rods, granular, molding plastic, impregnating liquids.
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KENT BROTHERS
Kingston, Ont., Canada

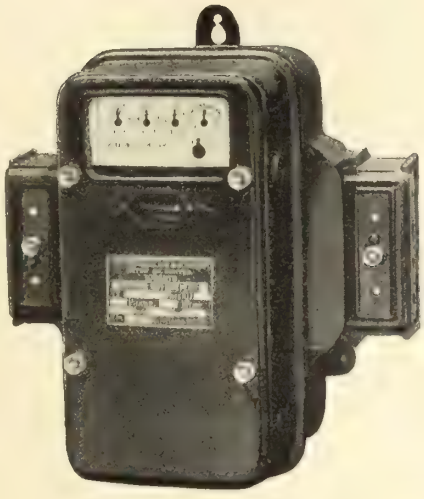
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Absorbs the Shock

Our special C. & H. Poly-Phase Meter is safe because it is fitted with new double terminal blocks that absorb the shock and reduce the danger of accident resulting from overloaded wires and from surge conditions during lightning storms.



This meter also has more inside room for the connections, and the three or four lines are carried straight through the meter from the left to right. In every respect this C. & H. Poly-Phase is a Safety Meter, and is undoubtedly the one to select for Installation on Long Distance Transmission.

C&H Poly-Phase The Safety Meter

The Company's guarantee goes with every instrument. The new Poly-Phase is as near perfect as it is possible for a meter to be.

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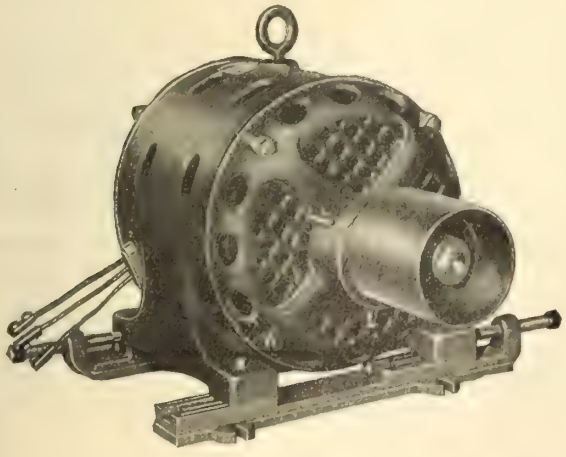
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Automatic Start Induction Polyphase Motor



The open ratings are based on a 40° Cent. temperature rise under continuous full load.

½ to 60 Horse Power

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THE "TYPE S" PORTABLE WHEATSTONE BRIDGE



Useful in the Shop and Laboratory for the Measurement of Resistance. Adapted for Fault Locations in Telegraph and Telephone Lines and Cables.

The Type S Bridge is a thoroughly practical instrument for shop and field use. Being complete in every detail it is ready at all times for immediate use. It is easily portable, its weight being but 8 pounds. The precision of adjustment of its coils (Rheostat 1/10 per cent., Ratio 1/20 per cent.) insures accurate measurements. The galvanometer, the weakest element of such an instrument, is unusually rugged. It is a separate element and may be removed for examination or repair by taking out two screws. The battery is of the ordinary "flash light" type, and renewals may be procured practically everywhere. The price is $66.25 net, f.o.b. Philadelphia, boxed for shipment.

Bulletin No. 530 describes this instrument.

THE LEEDS & NORTHRUP CO.

Electrical Measuring Instruments

4912 Stenton Ave. PHILADELPHIA, PA.



A "Galvaduct" Building

"GALVADUCT" and "LORICATED"

"GALVADUCT"

The most perfect interior construction conduit on the market.

Recognized as the standard of high quality.

Always specify Galvaduct or Loricated CONDUITS

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A high-class interior construction conduit of the enamelled type, proof against acid or other corrosive agents.

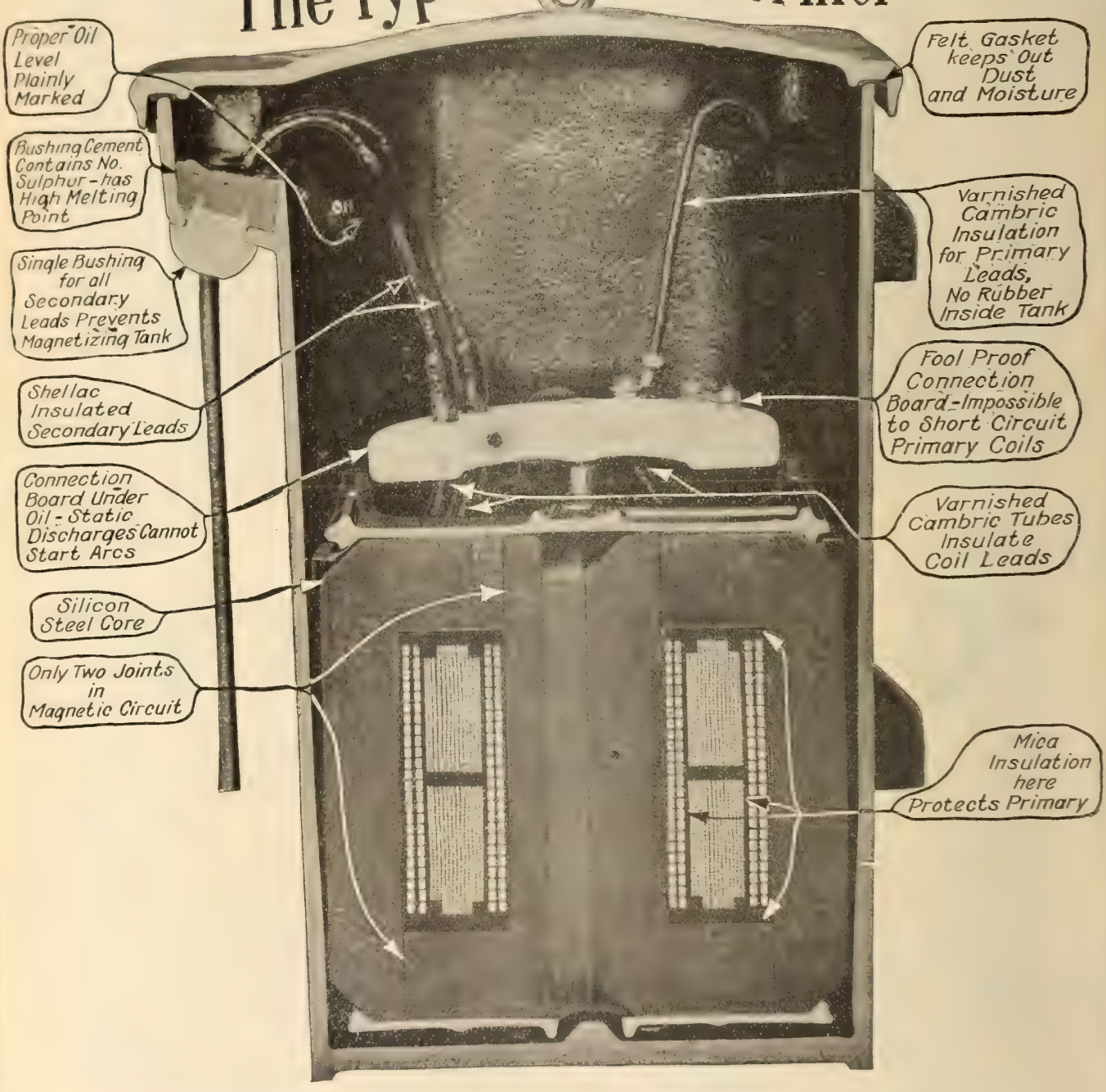
If your jobber cannot supply you—write us.

CONDUITS COMPANY

LIMITED

TORONTO

Look Inside The Type H Transformer



CANADIAN GENERAL ELECTRIC CO.

LIMITED

Head Office: Toronto. Sales Offices: Montreal, Quebec, Halifax, Sydney, Ottawa, Cobalt, South Porcupine, London, Winnipeg, Calgary, Edmonton, Nelson and Vancouver.

WE DON'T WORRY ABOUT THE COAL SUPPLY



WE ALWAYS USE C.G.E. ELECTRIC HEATERS

Note—These C.G.E. ELECTRIC AIR HEATERS include a great variety of styles and sizes and are listed in booklet 622 which will be sent by the Canadian General Electric Co., Limited, offices Toronto, Montreal, Quebec, Halifax, Sydney, Ottawa, Cobalt, South Porcupine, London, Winnipeg, Calgary, Edmonton, Nelson and Vancouver.

POLE LINE HARDWARE

Wire, (Copper or Galvanized), Bolts, Nuts,
Rivets, Washers, Screws, Pole
Steps, Guy Clamps, Cross
Arm Braces, Track
Equipment
Forgings

THE
STEEL COMPANY
OF
CANADA
LIMITED

HAMILTON MONTREAL



LIGHT INTENSITY

with a minimum of Power

is obtained with the

Pittsburgh Show Window Reflectors



They will increase the light 400 per cent. to 500 per cent. This has been established by scientific test.

Illustration shows "Pittsburgh" Reflector No. 100 for 100 or 150 Watt Lamp. Dimensions: Height, 8¼ inches; width, 8¾ inches; Holder, 2¼ in. Form "O."

It will be to your advantage to learn more about the efficiency of these Reflectors. Write to-day for illustrations of the different types of reflectors for show windows and indirect lighting.

Pittsburgh Reflector and Illuminating Co.

PITTSBURGH, PA.

Canadian Distributors

JAMES DEVONSHIRE, Ltd.

701 Yonge Street, Toronto

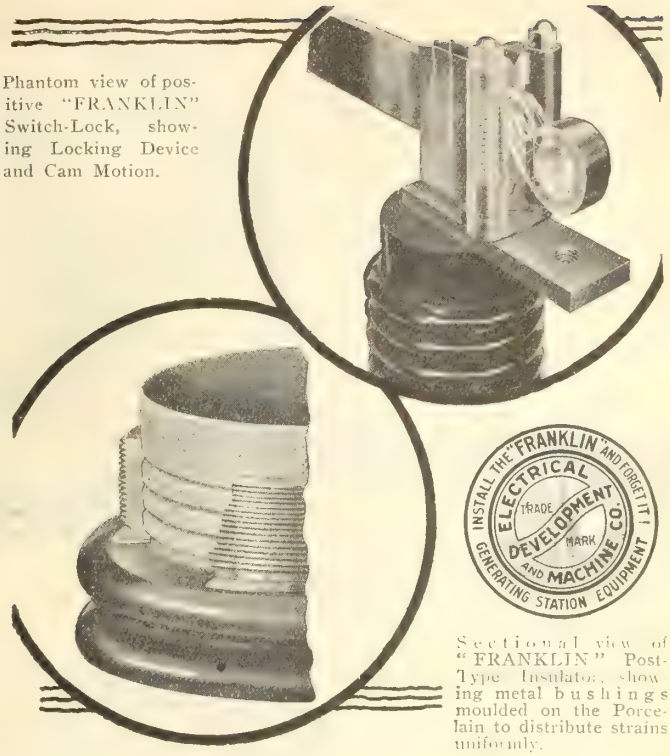
Tenders Wanted

should be advertised for in the "Tenders and For Sale Department" of the CONTRACT RECORD AND ENGINEERING REVIEW. This paper is the "Tender Ad." medium of Canada and always brings bids from the reliable contractors and supply houses. File your plans for any work on which you are inviting bids in our offices at Toronto, Montreal, Winnipeg or Vancouver.

Contract Record

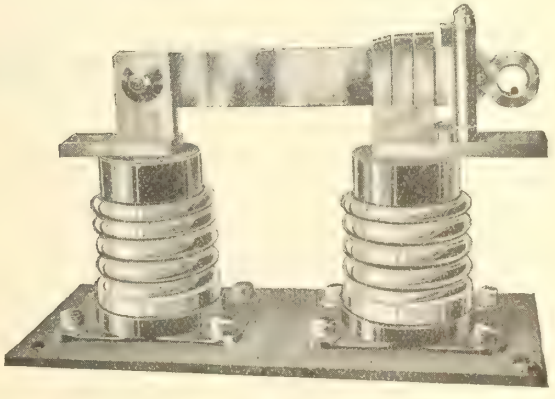
and Engineering Review

TORONTO — ONTARIO



Phantom view of positive "FRANKLIN" Switch-Lock, showing Locking Device and Cam Motion.

Sectional view of "FRANKLIN" Post-Type Insulator, showing metal bushings moulded on the Porcelain to distribute strains uniformly.



When the blade slips in, this switch is **locked**—locked to **stay** locked until you **want** it open.

The greater the expulsion strain, the tighter the jaws of a "FRANKLIN" Lock will grip. Yet a single easy pull from any angle, with any kind of hook, will release the blade and open the switch.

The "FRANKLIN" Disconnecting Switch is described fully in Bulletin No. 1250. When you write, state service and voltage.

SELLING AGENTS

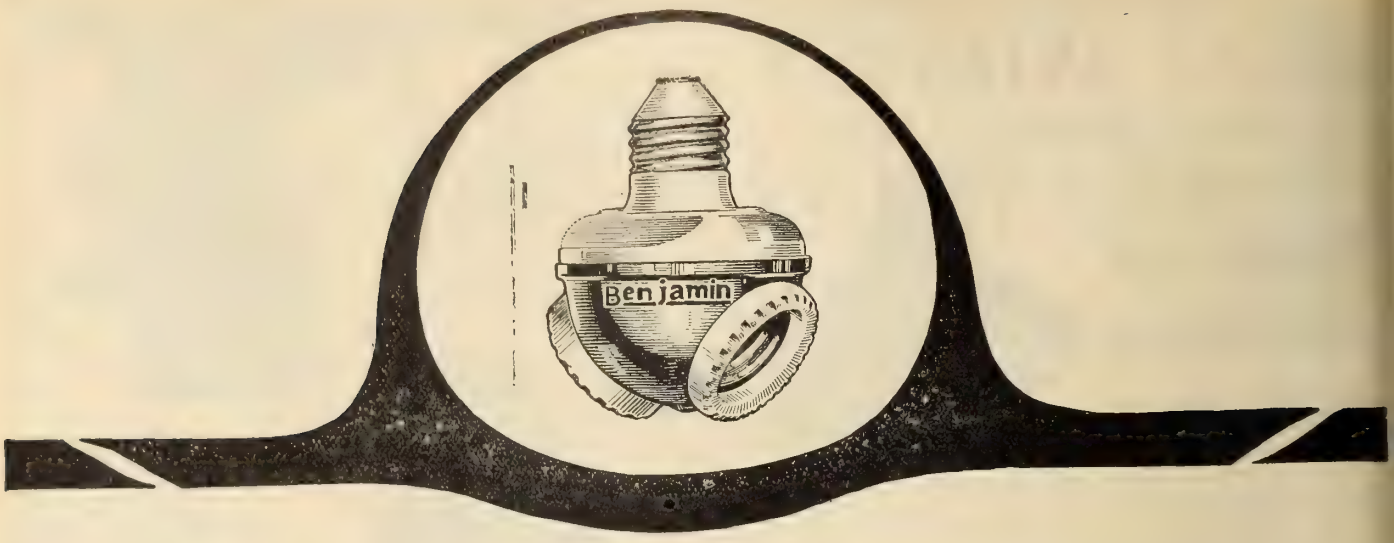
THE PHILADELPHIA ELECTRIC COMPANY SUPPLY DEP'T.

132 South Eleventh Street

Philadelphia

"FRANKLIN"

Disconnecting Switches—Insulators—Potheads—etc.



The Genuine

Benjamin Two-way-Plug

Some dealers have been misled or persuaded into stocking imitations of the BENJAMIN Two-Way-Plug, and are, in due course, passing these on to their customers.

If a dealer believes it in his interest to handle another line of goods than ours, we can do nothing but try to convince him how and why ours are supreme—and we will welcome the opportunity to do so.

But we feel sure you will realize with us how detrimental it is to **both** our interests should a customer of yours obtain from your store a Two-Way Plug of **inferior quality** —far below the recognized electrical standard in details of construction and actually **dangerous in use**—yet so closely **copied in appearance from the BENJAMIN**—that this customer actually believes he has obtained the genuine article.

Imagine his feelings towards us both when he discovers the inferiority of the plug he has bought!

Your customer **wants** the BENJAMIN, because **we** have practically sold him already through **our** advertising. In the new campaign we are now commencing we are going to teach him still more how to know the genuine from the imitation, and why he should **insist** upon the BENJAMIN **only.** It will pay you to link up with this campaign.

Insist on MAKERS OF Benjamin PRODUCTS OF CANADA **Products**

Two-Way-Plug

ELECTRIC LIGHTING SPECIALTIES *INDUSTRIAL LIGHTING*

Made in Canada by

Benjamin Electric Manufacturing Company of Canada, Limited

11-17 Charlotte Street, Toronto

MARCHAND CLAMPS FOR STRANDED WIRES AND CABLES



Marchand Clamps are the safest and most efficient Wire Clamps on the market.

Marchand Clamps are easily and quickly installed and save labor and material.

Marchand Clamps securely grip each wire of strand, eliminating strains which tend to weaken the strand.

Marchand Clamps cannot wear out or break and have been thoroughly tested and will not rust.

WRITE FOR COMPLETE CATALOG No. 33

STEEL CITY ELECTRIC COMPANY
"The Quality Line"
PITTSBURGH, - PENN. U. S. A.

"KILLARK" ENCLOSED FUSES 600 VOLT

NATIONAL ELECTRICAL CODE STANDARD TO 400 AMPERES, INCLUSIVE



"APPROVED."

Our 600 Volt Line of Fuses are acurately made, properly cartoned and Boxed.

We Make Good Deliveries.

KILLARK ELECTRIC MFG. COMPANY
ST. LOUIS, Mo., U.S.A.

Canadian Sales Agents

HATHEWAY & KNOTT, Inc.

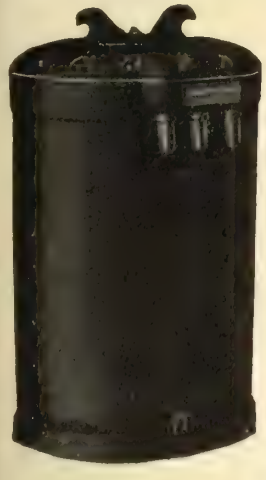
Electrical Merchandise **120 Liberty Street, NEW YORK**

New York Headquarters for the Canadian Electrical Trade

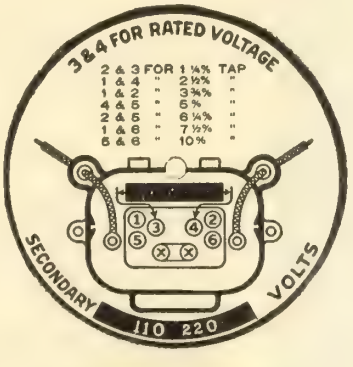
Moloney Service Transformers

are all supplied with brass plates fastened on the inside of the cover of each transformer; all connections marked plainly. They do not get covered with dirt or stained with oil like a blue print does. You always have them before you when changing taps. Heavy bushings eliminate breakages in shipment and handling

Moloney Transformers are manufactured in a factory that was built especially for that purpose only. They are designed by Engineers and built by men who make a specialty of this work.



Subway Type



Made in Canada



Pole Type

MOLONEY ELECTRIC COMPANY OF CANADA, LIMITED

Factory Windsor, Ont.

Head Sales Office Bank of Hamilton Bldg., Toronto

Branch Offices Montreal, Halifax, Winnipeg, Vancouver



The Higher Rate of Interest and Security

creates the premium on bonds

The Higher Efficiency of

ERICO Welded Terminal Rail Bonds

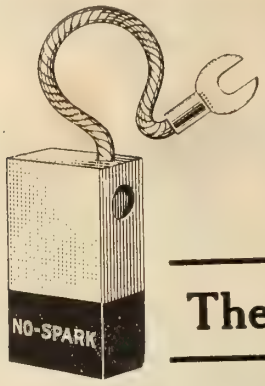
is alone a premium to which may be added the inducements of strength, durability, low cost and ease of installation.

The ERICO Portable Welder

installs the bonds and the ERICO Rheostat that accompanies it, is also an arc welding set for building worn rails and for innumerable repair jobs.

A request for information will be promptly answered.

THE ELECTRIC RAILWAY IMPROVEMENT CO.
CLEVELAND, OHIO



No Spark Brushes.

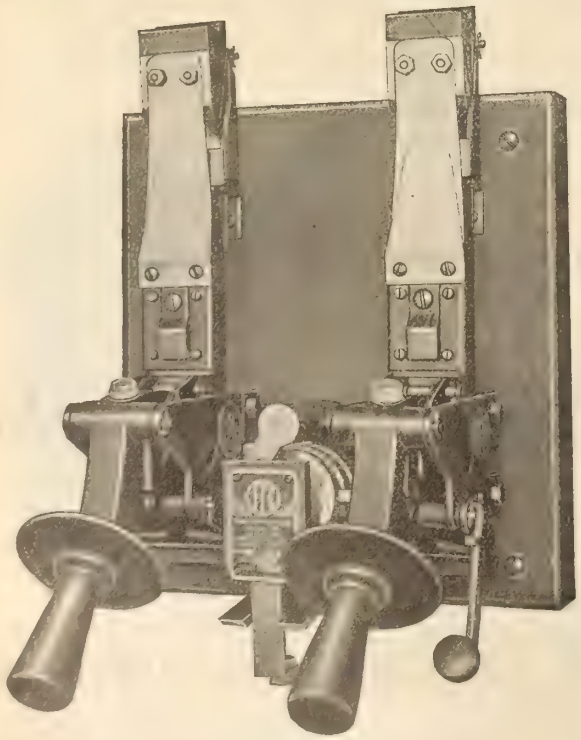
They Don't Spark

because they don't cause friction in the generators. They don't crumble, crack or break. In hundreds of cases NO SPARK BRUSHES have outlasted 8 to 12 sets of ordinary brushes. Grades and sizes to suit all Electrical Machines. Let us prove our claims to you. Our engineers are at your service to insure proper selection of grade best suited for each machine.

Our interesting bulletins explain all about these brushes.

CALEBAUGH
Self-Lubricating Carbon Co.
1503 Columbia Ave., PHILADELPHIA, Pa.

I-T-E CIRCUIT BREAKERS



Type W

Rush orders mean unexpected breakdowns unless guarded against. An ounce of CIRCUIT BREAKER PREVENTION will save a ton of trouble.

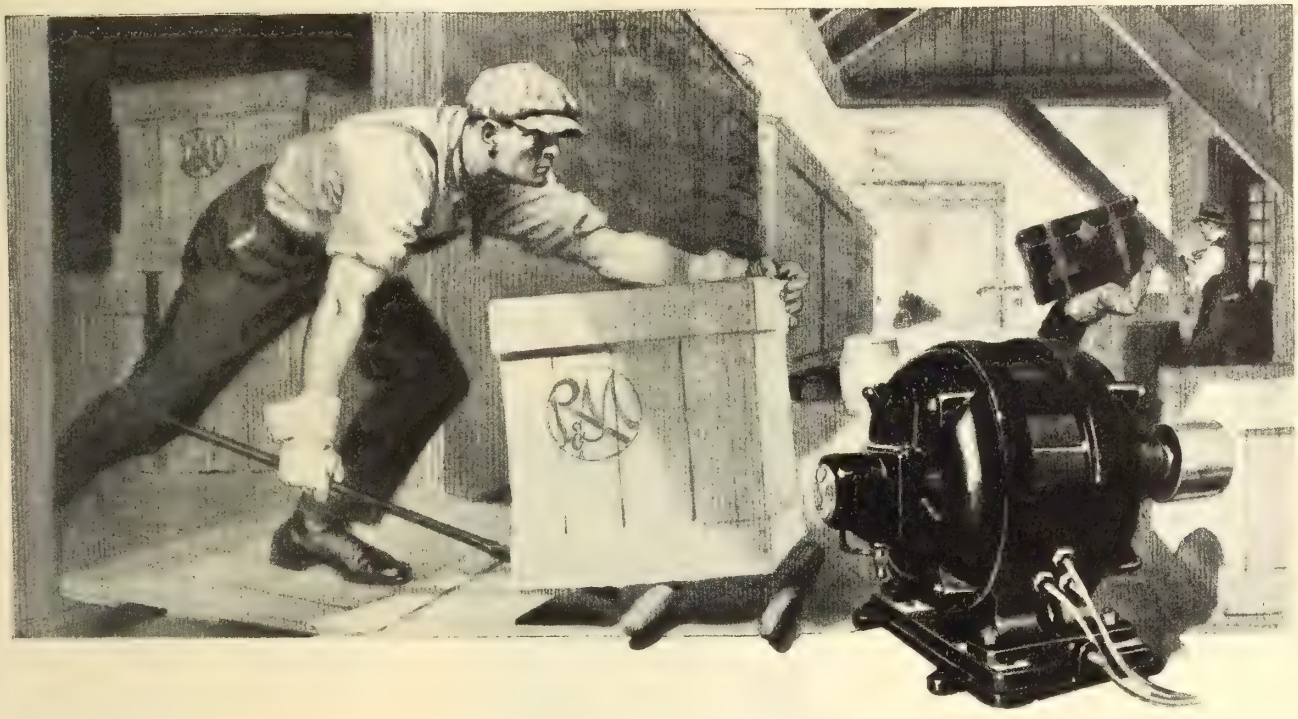
I-T-E CIRCUIT BREAKERS

pay for themselves frequently before you pay us for them. Prompt deliveries.

THE CUTTER COMPANY
Bank of Hamilton Building, Toronto
Main Office and Factory: Philadelphia, Pa.

New York, 50 Church St.
Detroit, Mich., Ford Bldg.
Indianapolis, Ind., Telephone Bldg.
Chicago, Monadnock Block.
Pittsburgh, Park Building.
Minneapolis, Metropolitan Life Bldg.

ECCLES & SMITH COMPANY
Los Angeles San Francisco Portland, Ore.



The Right Start For a Profitable Resale Motor Business

With the arrival of his first order of R & M Motors, the dealer has made a start which will insure a healthy, permanent growth in his motor business.

The unfailing reliability and efficient operation of R & M Motors win friends for them wherever they are installed. Satisfied users and repeat orders can be counted upon as a certainty by the dealer who sells R & M Motors.

Their service records hold old customers for the dealer and permit him to concentrate his efforts on new prospects.

As a rule it is easy to get prospective users to try R & M Motors, too. This motor has been advertised dominantly in the leading magazines for a decade, and its reputation for reliability is pretty generally known everywhere—to prospective motor users as well as to experienced motor buyers.

The dealer who is planning for a permanent, growing motor business finds great value in the R & M policy of making good motors and keeping the public informed on them.

THE ROBBINS & MYERS CO., SPRINGFIELD, OHIO.

New York, Philadelphia, Boston, Buffalo, Cleveland, Cincinnati, Chicago, St. Louis, San Francisco.

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Robbins & Myers Motors

Reduces the Coal Bill

HUGHES
Electric Air Heaters

Solves the cold weather problem of properly heating each room.



Adds to the charm and comfort of any living room.

Made in Six Sizes

Catalogue No.	Wattage	Size inches	Wt. Lbs.
AH 103	1000	9 x 15 x 17½	12½
AH 153	1500	9 x 15 x 20½	13½
AH 203	2000	9 x 15 x 23½	14½
AH 253	2500	9 x 19½ x 23	23½
AH 303	3000	9 x 19½ x 23	23½
AH 403	4000	9 x 22¼ x 23	25
AH 503	5000	9 x 22 x 23	25

For individual room heating

The great economy problem this Fall and Winter will be the low cost of heating the home. Whether the present heating system is the old-fashioned coal heater or the modern hot water system it can be regulated to conserve fuel. But in doing this, all the rooms are not being properly heated.

The Hughes Electric Air Heater is an auxiliary heater which acts as a fill-in and makes this fuel conservation possible. The heat is instantly regulated to the requirement which makes it ideal for individual room heating. Portable, and can be moved from room to room—quickly warming it to a comfortable temperature.

HUGHES ELECTRIC HEATING CO.
364 RICHMOND ST. WEST - - - TORONTO

Electrical News
Generation, Transmission and Application of Electricity

Published Semi-Monthly By

HUGH C. MacLEAN, LIMITED

HUGH C. MacLEAN, Winnipeg, President.
THOMAS S. YOUNG, General Manager.
W. R. CARR, Ph.D., Editor.

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Orders for advertising should reach the office of publication not later than the 5th and 20th of the month. Changes in advertisements will be made whenever desired, without cost to the advertiser.

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The "Electrical News" will be mailed to subscribers in Canada and Great Britain, post free, for $2.00 per annum. United States and foreign, $2.50. Remit by currency, registered letter, or postal order payable to Hugh C. MacLean, Limited.

Subscribers are requested to promptly notify the publishers of failure or delay in delivery of paper.

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Vol. 27 Toronto, October 15, 1918 No. 20

Continent's Total Water Power Insufficient for Present Demands

What may be considered the most valuable contribution to the year's literature on electrical progress, was the paper recently presented by Dr. C. P. Steinmetz, before the American Institute, on the general subject of energy, coal and water conservation. Dr. Steinmetz does more than deplore the rapid depletion of the continent's hard coal areas—he points a way to supplement them. And, first of all, he pricks that bubble of illusion of the oft-repeated statement to the effect that, after all, the coal doesn't matter so much—we have our water powers left. In answer to this, Dr. Steinmetz points out that if every drop of rainfall on this continent were caught and transformed into power, it would not be sufficient to take care of even the present day demands of our homes and industries, to say nothing of rapid and constant developments. At best our water powers, all of them put together, can merely be used as supplementary to our coal supply. The real source of energy to which we must look is the sun—and here, in the author's opinion, lies the hope of the distant future.

Dr. Steinmetz's suggestion for immediate conservation lies in the use of the induction generator. The present type of generating station is expensive, due to a multiplicity of the necessary regulating and protective equipment, which makes it impracticable to develop any but the largest and most favorably situated waterfalls. By the use of the induction generator the construction is greatly simplified and reduced in price and, as a result, water falls from 50 h.p. upwards could be utilized. By this arrangement the present system of distribution from large generators out along a network of lines to induction motors, would simply be reversed, and instead we should have a number of small induction generators feeding into a network of collecting lines. Small coal areas could be utilized in the same way.

The subject is treated from the standpoint of the citizen of the United States, but is no less interesting to Canadians on account of our dependance on U. S. coal. Canada's water powers, in proportion to our population, are greater than those of our neighbors, but much the same on the basis of area, and plainly we have nothing to give away or waste. It may be that the induction generator could be used to advantage on some of our smaller waterfalls or coal or oil fields, or possibly in connection with the utilization of our peat areas.

Disjointed Policy of City Regarding Toronto Street Railway

The operating situation on the Toronto Street Railway System has apparently become unmanageable from the company's standpoint and uncomfortable for the patrons. The plain fact appears to be that the company has not enough employees to man the cars, and has trouble with those it has. Quite recently an effort was initiated to train young women as conductors, but the "Union" threatened a strike and apparently the management have thought it best to drop the plan. Overcrowding at rush hours, both on the company and city lines, has reached a point where it hovers somewhere between bestiality and immorality and there is no evidence of relief in sight. The policy of the city as regards the street railway company is, and always has been, absolutely disjointed, so that the sum total of these spasmodic efforts is to embarass the company's operations.

There is little chance of improvement in conditions so long as no effort is made by the city authorities to advise themselves of the actual and adverse conditions under which the company is operating. While the two parties are continually at variance over even the smallest details, the service daily grows worse and the public bears all the inconvenience. The Toronto Railway Company know how to give a good service, because in former times it did so. All that is necessary, we believe, is the removal of the whole question from the political arena, and a capable committee to negotiate with the company. There can be no excuse for waiting. No one imagines or hopes that the city will be in a position to take over the system when the franchise expires. Why not settle the question of franchise now. Give the company some decent moral support and then see to it that they live up to their agreement. They will do it—willingly—if the city council will give them such assistance as will make it possible.

Another Private Power Project

Encouraged by the recent success of the St. Lawrence Power Company, the New York & Ontario Power Company has applied to the International Joint Commission for approval of its plans to construct a dam across the Little River on the South branch of the St. Lawrence, at Ogden Island. Canadian interests raise the objection that the dam would seriously affect navigation, and it is the intention of the government and the Dominion Marine Association to oppose the company's application.

The St. Lawrence River has enormous potentialities that should be developed in the most efficient and economical manner for future generations. The Canadian and American governments should keep the control of the river in their own hands. The war necessity plea of the St. Lawrence Power

Company cannot be urged in the case of the New York and Ontario Company.

The present power shortage in the Province of Ontario should convince the most skeptical that the water powers of the St. Lawrence River must be fully developed at an early date if our industries are not to suffer. This development must not be undertaken a piecemeal way, but according to a well-devised general plan, which will make the most of every available drop.

The alienation of little bits of power here and there threatens to make the larger development scheme impracticable and well-nigh impossible. It seems as if the time had arrived for the two Governments to get together, map out the whole plan of construction and initiate it forthwith either as a government enterprise or well-guarded concessions to private companies. No diversion of any water and no development work of any kind whatsoever should be considered for one moment, however, that is not a part of the general predetermined plan of the total final utilization of the river.

Canada's Grounds of Opposition.

The Dominion Government is opposing the company's application on the grounds that:

(1) It will interfere with the full and economic development of the St. Lawrence system as regards the navigation thereof and the power potentialities therein, which are common to both bordering countries and of equal advantage to each country.

(2) It will interfere with the complete regulation, by a dam at Canada Island, of the level and outflow of Lake Ontario.

(3) The future development of the river will necessitate the acquisition of any rights the applicant may have in the river, and the Government of Canada considers it inadvisable to create more.

(4) The St. Lawrence River has enormous potentialties that should be developed in the most efficient and economical manner for future generations. Such a piecemeal policy as proposed is not in conformity with this doctrine.

The Dominion Government claims also that original grantees' rights from the applicants' claim title have lapsed, and that the applicants, as successors, are now asking something entirely different from the privileges granted by the original acts of the Legislature of New York.

Montreal Electrical Luncheon

The Montreal electrical luncheon has made a promising start for the 1918-19 season. The opening meeting, on October 2nd, was well attended, the discussion being confined to the election of officers and committees, and to making arrangements for the season. Mr. W. H. Winter of the Bell Telephone Co. presided, and asked for such support as would make the luncheons a credit to the electrical fraternity of the city.

The following were elected members of the general committee:—Messrs. R. J. Beaumont, Shawinigan Water & Power Company; P. T. Davies, Southern Canada Power Company, Limited; W. J. B. Drew, Montreal Public Service Corporation; C. Duncan, Duncan Electrical Company, Limited; M. C. Gilman, Packard Lamp Company; A. S. Henry, Canadian Comstock Company, Limited; H. Hulatt, Grand Trunk Railway Telegraphs; L. A. Johnson, Northern Electric Company, Limited; J. McMillan, Canadian Pacific Ry. Co's. Telegraphs; W. P. Roper, Canada Wire & Cable Company, Limited; Wm. B. Shaw, Montreal Electric Company, Limited, and H. W. Wood, Canadian Crocker Wheeler Company, Limited. In addition to these, the members of the Finance, Luncheon, Papers, and Entertainment committees, whose names are given below, are members of the general committee.

The papers committee consists of Messrs. G. C. Read, (chairman), Montreal Light, Heat & Power Consolidated; P. A. McFarlane, Bell Telephone Company; J. A. Shaw, Canadian Pacific Railway Company, and G. E. Templeman, Electrical Service Commission; and the Luncheon Committee of Messrs. S. W. Smith, (chairman), Electrical Equipment Company, Limited, and A. J. Carroll, Eugene F. Phillips Electrical Works, Limited.

Mr. W. H. Winter was again appointed president, and Mr. T. H. Chennell re-appointed secretary-treasurer

The question of financing the luncheon was discussed at some length, the expenses being nearly $200. The old committee suggested that a fee of $2 be charged to those who desired to become regular members of the luncheon, although no one connected with the electrical industry would be debarred from attending. After several other suggestions had been made, the following were appointed to look after the financial arrangements, including contributions from the large electrical companies—Messrs. J. W. Pilcher, (chairman), Canadian General Electric Company, Limited; J. J. Sorber, Economy Fuse & Mfg. Co. of Canada, Limited; C. Thomson, Fred Thomson Company, Limited; and J. B. Woodyatt, Southern Canada Power Company, Limited.

The question of emphasizing the social side of the luncheons was brought up by Mr. Winter, and with this end in view it was decided to appoint a committee to make arrangements for one or more smokers. The following are the committee: Messrs. A. Dwight Smith, (chairman), Northern Electric Co. Limited; E. W. Sayer, Sayer Electric Co., and A. C. Towne, Dominion Lamp Company.

A vote of thanks was passed to Mr. E. N. Hyde, the chairman of last season's paper committee.

Montreal Tramways Company Gets Reasonable Treatment

In view of the heavy advance in the cost of operating street railways, the judgment of the Quebec Utilities Commission in the appeals of the Montreal municipalities against the decision of the Montreal Tramways Commission is of interest. The Utilities Commission varied that decision, but found that there is justification for higher fares. In what is known as the uniform tariff territory the fare is fixed at 6c or 5 tickets for 25c, with workmen's tickets at six for 25c, in place of 5c or 6 tickets for 25c, and 8 tickets for 25c, respectively, which were the old rates. The night tariff of 15c cash is an addition of 5c. Transfers are free. The Commissioners only slightly varied the decision of the Tramways Commission as to outlying districts, passengers going from the uniform tariff territory to these outside districts paying the city fare plus the fare in the outside municipalities. The company claimed a 7c fare or 4 tickets for 25c. in the uniform tariff territory with free transfers.

Under the contract of the city with the company, certain fixed charges have to be provided for, and the chief points at issue were as to the probable additional charges for maintenance and operation, which the company contended justified it in asking for a 7c fare. The Commission employed an accountant to check over the company's estimates, and he made an independent report upon the various items. The conclusion on the increased cost of material is that "sixty-one per cent of the average purchases to be made in 1918-19 will actually cost $423,884.60 more than they did in 1916-17, and that sixty-two per cent. of the average purchases to be made in 1918-19 will cost $189,965.09 more than 1917-18. As the sixty-one per cent. in 1916-17 amounted to $1,017,830.83, and the sixty-two per cent. in 1917-18 to $1,-

424,894.73, the percentage of increase is somewhat startling, being roughly 42 and 13, respectively."

The Commission estimated the revenue under the old schedule at $7,625,000, and the expenditure at $9,249,407, including interest on $36,286,295, the capital of the company, as valued by the Tramways Commission. This would leave a deficit of $1,624,407—and "manifestly it is, under these circumstances, impossible to maintain present rates." The new tariff is estimated to yield $9,363,094, to meet expenditure of $9,343,038, the latter sum including $93,630 for the annual contribution to the contingent fund, not reckoned in the first named estimate of expenditure.

"The margin between revenue and expense is very small and we are not averse that it should be so. We are dealing with a time of abnormal scarcity and high prices, not one in which to accumulate a reserve. Under the terms of the contract the interests of the shareholders and of the city of Montreal as a corporation are quite sufficiently protected, and the accumulation of a surplus can be left to a more favorable opportunity. As it is, the contract leaves us no option in the matter of making the revenue meet the expense of operation and maintenance. We have done this to the best of our ability and, in our opinion, we should not be justified in doing any more."

The new fares are now in operation, and the company has also altered the old transfer system, by punching on the transfers the point at which the passenger desires to change cars. Hitherto passengers were able to transfer at any point along the route without designating that point when boarding the car.

The report of the Montreal Tramways Co. for the year ended June 30th, indicates that the surplus was drawn on to the extent of $303,991, it now standing at $552,457. The total earnings were $5,526,796, and the expenses $5,830,787, this sum including three quarterly dividends of 2½ per cent., the one due August 1st having been deferred.

Toronto Section A. I. E. E.

The programme at the October 4th meeting of the Toronto section of the A.I.E.E. took the form of a discussion on the subject: "The Grounded Neutral."

Mr. W. P. Dobson, in opening the discussion, outlined the different methods of operation of h.t. lines, showing that important and extensive systems were working with dead ground, resistance ground, ungrounded star and delta connections with evident satisfaction.

Mr. P. Ackerman dealt with the advantages of the isolated neutral covering both Y and delta systems. Possibility of maintaining operation with one line grounded was of value.

Mr. H. C. Don Carlos was strongly in favor of a ground with moderate resistance on h.t. lines as yielding less strain on the insulation, but preferred the delta connection for distribution work. The grounding resistance results in less mechanical strain on the generators and transformers; he believes that a reactance shunted by a high resistance would form the ideal ground connection. The Central Ontario system had been operating some years with isolated Y, but it was intended to ground in the near future to save the insulators, which were showing signs of fatigue.

Mr. W. G. Gordon gave an interesting account of the results from arcing grounds on an ungrounded system with a theoretical consideration of the frequencies and voltages possible under various conditions of resonance, etc.

Mr. A. J. Jones (Niagara Falls Power) is about to ground a 22,000 volt. system, after running isolated for some years. It was found that a circulating current of 800 amps. was flowing between their Westinghouse and G. E. generators, but none between machines of the same make. Ground resistance of 3 ohms. was proposed.

Mr. O. V. Anderson claimed that a distribution system is subject to the same laws and reasoning as a transmission system and grounding in both cases provides continuity of service by locating trouble as soon as it occurs, which is a much greater advantage than the possibility of operating during a fault. The only case of telephone interruption in his experience was found to be due to a bad ground on the telephone company's own system.

Mr. D. A. McKenzie favored dead ground under all conditions; the use of a resistance does away with the good effect of the ground connection. The strain on transformers would certainly be obviated by the reactance of the lines in a large system.

Mr. A. L. Mudge was strongly of the opinion that there is room for difference of judgment in the matter of grounding. For a typical small system of 20,000 kw. 22,000 or 44,000 volts, supplied by a single generating station, ungrounded Y would be preferred. Some initial trouble had been obviated by grounding.

Mr. E. J. T. Brandon showed that the costs of equipment on a delta system were higher than with a grounded Y.

Mr. F. T. Wyman stated that the cost of the main transformer would show small disparity. In any case a ground connection should have a resistance or reactance to take the strain off the transformer. In some cases transformers broke down, due to the fact that the whole line voltage was thrown on the first few turns causing stresses which no transformer would be expected to carry.

Mr. J. B. McCarthy (Can. Copper Co.)—On a 60 mile, 33,000 volt. line delta—delta connection found to be quite o.k.; some poles had been burnt, but the fact of its being a wood pole line helped to keep the load on in case of a short.

Mr. H. B. Dwight believed the problem to be one of operating voltage. Below 60,000 v. it might be all right to operate with isolated neutral.

Mr. P. Ackerman was of the opinion that ground resistance should be as low as possible; preferably nil. It has no draining off function because this is effected by the lightning arresters. As to the strain on transformers, they should be designed to carry a short circuit to ground in any event.

Mr. R. W. Osborne pointed out that while ordinary frequency occasions no disturbance on telephone lines the higher harmonies induced on the h.t. lines do cause trouble and therefore grounding is more necessary on h.t. than on l.t. systems.

Messrs. P. A. Borden and R. R. Stevenson also spoke briefly.

The Electric Club of Toronto

The Electric Club of Toronto held two more successful luncheons on September 27 and October 4. On the former Friday Mr. Walter Chapman, the well-known architect, was the speaker on "Architecture." On Friday, October 4th, Mr. J. A. D. McCurdy, Canada's pioneer airman, described the evolution of the aeroplane beginning with the earliest history of the "gliding" machine, up through the controversy between the "heavier than air" and "lighter than air" advocates, to the present day. The members were specially pleased to have with them on this occasion, also, Mr. McFarlane, the president of the Bell Telephone Company, who spoke briefly.

The Energy Supply of North America

Dr. Steinmetz Before the A.I.E.E. urges the Conservation of Coal and the Utilization of all Possible Water powers—The Supply of Both is Limited

The only two sources of energy which are so plentiful as to come into consideration in supplying our modern industrial civilization, are coal, including oil, natural gas, etc., and water power.

While it would be difficult to estimate the coal consumption directly, it is given fairly closely by the coal production, at least during the last decades, when wood as fuel became negligible; and export and import, besides more or less balancing each other, were small compared with production. Coal has been mined since 1822, and in Table 1 is recorded the coal production of the United States, from governmental reports—the decennial averages in millions of tons per year.

Table I.

Average Coal Production of the United States.

Year	Million tons	Percent increase per year
1825	0.11	
1830	0.32	22.4
1835	0.83	19.7
1840	1.92	17.0
1845	4.00	14.5
1850	7.46	10.45
1855	10.8	8.35
1860	16.6	8.72
1865	25.9	9.22
1870	40.2	8.58
1875	56.8	7.42
1880	82.2	7.95
1885	122	6.80
1890	160	5.40
1895	206	5.75
1900	281	6.96
1905	404	6.60
1910	532	

Estimating the chemical energy of the average coal as a little above 7,000 calories, the chemical energy of one ton of coal equals approximately the electrical energy of one kilowatt-year (24-hour service). That is, one ton of coal is approximately equal in potential energy to one kilowatt-year.

Thus, the annual consumption of 867 million tons of coal (estimate of this year's production) represents in energy 867 million kilowatt-years. However, as the average efficiency of conversion of the chemical energy of fuel into electrical energy is probably about 10 per cent, the coal production would be able, if converted into electrical energy, to give about 87 million kilowatts.

Assuming, however, that only one half of the coal is used for power, at 10 per cent efficiency, the other half as fuel, for metallurgical work, etc., at efficiencies varying from 10 to 80 per cent, with an average efficiency of 40 per cent, we get in electrical measure 217 million kilowatts (24-hour service) as the total utilized energy of our present annual coal production of 867 million tons.

Potential Water Powers of the United States

Without considering the present limitation in the development of water powers, which permits the use of only the largest and most concentrated powers, we may try to conceive the total amount of hydraulic energy which exists in our country, irrespective of whether means have yet been devloped or ever will be developed for its complete utilization. We then proceed from the estimation of the energy of the total rainfall.

The total rainfall of the North American continent between 30 and 50 degrees latitude represents 3000×10^{15} kg-m. This equals 950 million kilowatt-years (24-hour service). That is, the total potential water power of the United States, or the hydraulic energy of the total rainfall, from the elevations where it fell, down to sea level, gives about 1000 million kilowatts.

However, this is not available, as it would leave no water for agriculture; and, even if the entire country were one hydraulic development, there would be losses by seepage and evaporation.

An approximate estimate of the maximum potential power of the rainfall, after a minimum allowance for agriculture and for losses, (in this, 12.5 cm. rainfall has been allowed for wastage, and 25 and 37.5 cm. respectively, for agriculture, where such is feasible) gives as total available potential energy about 1200×10^{15} kg-m., or 380 million kilowatts (24-hour service).

Assuming now an efficiency of 60 per cent from the stream to the distribution centres, there remain 230 million kilowatts (24-hour service) as the maximum possible hydroelectric power which could be produced if, during all seasons, every river, stream, brook, or little creek throughout its entire length from the spring to the ocean, together with all the waters of the freshets, could be and were used. It would mean that there would be no running water in this country; in fact, there would be only stagnant pools connected by pipe lines to turbines exhausting into the next lower pool. Obviously, we could never reasonably hope to develop more than a part of this power.

It is interesting to note that the maximum possible hydraulic energy of 230 million kilowatts is little more than the total energy which we now produce from coal, and is about equal to the present total energy consumption of the country including all forms of energy.

This is rather startling. It means that the hope that when coal once begins to fail we may use the water powers of the country as source of energy is and must remain a dream; for if to-day all the potential water power of the country were developed and every rain drop used it would not supply our present energy demand.

Thus hydraulic power may and should supplement coal as a source of power, but can never replace it.

This probably is the strongest argument for efforts to increase the efficiency of our means of using coal.

Solar Radiation.

The source of energy, which is practically unlimited, if it only could be used, is solar radiation. Estimating the solar radiation at the earth surface as 1.4 calories per sq. cm. per min. would give, per sq. cm. horizontal surface between latitudes 30 and 50, assuming 50 per cent. cloudiness, an average throughout the year (24 hours per day) of about 0.14 calories per sq. cm. horizontal surface per min. and on the total area of North America, between 30 and 50 latitude, 8.3 million square kilometres, a total of approximately 800,000 million kilowatts (24-hour service)—a thousand times as much as the total chemical energy of our coal consumption,

or 800 times as much as the potential energy of the total rainfall.

Considering that the potential energy of the rainfall—from surface level to sea level—is a small part of the potential energy spent by solar radiation in raising the rain to the clouds, and that this is a small part of the total solar radiation, the foregoing is reasonable.

Considering only 2.7 million square kilometers, which are assumed as unsuited for agriculture, and assuming that, in some future time and by inventions not yet made, half of the solar radiation could be collected, this would give an energy production of 130,000 million kilowatts.

Thus, even if only one tenth, or 13,000 million kilowatts, of this could be realized, it would be many times larger than all the energy of coal and water power. Here then would be the great source of energy for the future.

Hydro-electric Stations—The Modern Synchronous Generator Station.

In developing the country's water powers, thus far only those of greatest energy concentration have been considered, that is, those where a large volume and a considerable head of water were available within a short distance.

This led, as the best solution for the problem, to the present type of hydro-electric generating station. Due to the high powers controlled by these stations, the auxiliary and controlling devices have become so numerous as to make the station a complex structure requiring high operating skill and involving high cost of installation.

Not only are all these devices necessary for the safe operation of the station, but at the same time it must be expected that, with the further increase of power of our electric systems, additional devices will become necessary for safe and reliable operation. One such device is the automatic recording apparatus, such as the multi-recorder.

With this type of station it obviously is not possible, in most cases, to develop water powers of small and moderate size, and a generating station of a thousand horse power will rarely, or one of a hundred horse power hardly ever, be economical.

On the other hand, a hundred horse power motor installation is a good economical proposition, and the average size of all the motor installations is probably materially below one hundred horse power.

It is startling to see how large a part of the potential water power of the country is represented by relatively small areas of high elevation, in spite of the relatively low rainfall of these areas. As most of these areas are at considerable distances from the ocean, most of the streams are small in volume. That is, it is the many thousands of small mountain streams and creeks, of relatively small volume of flow but with high gradients affording fair heads, which apparently make up the bulk of the country's potential water power.

Only a small part of the country's hydraulic energy is found so concentrated locally as to make its development economically feasible with the present type of generating station. Therefore some different and very much simpler type of generating station must be evolved before we can attempt to economically develop these many thousands of small hydraulic powers, and collect the power of the mountain streams and creeks.

Simplification of the Hydro-electric Station.

The following discussion of the simplification of the Hydro-electric station to adapt it to the utilization of smaller powers is limited to the case where smaller hydraulic stations fed into a system containing some large hydraulic sta- steam-turbine stations from which the system may be controlled.

We may eliminate the low-tension busbars, with generator circuit breakers and transformer low-tension circuit breakers, and connect each generator directly to its corresponding transformer, making one unit of generator and transformer, and do the switching on high-tension busbars which, with the circuit breakers, can be located outdoors. While it is dangerous to transformers to perform the switching on the high-tension side, due to the possibility of cumulative oscillation, this danger is reduced by the permanent connection of the transformer to the generator circuit, and is less with the smaller units used in small power stations, and therefore permissible in this case. However, the simplification effected is pronounced, since ammeters, voltmeter and synchronizing devices with their transformers are still retained on the low tension circuits.

Since it is not economical to operate at partial load, proper operation of a hydraulic station on a general system requires that as many units operate fully loaded as there is water available for, and to increase or reduce the number of units (of turbine, generator, and transformer, permanently joined together) with the changing amount of available water, thus using all the energy of which the water is capable.

In this case the turbine governors, with their more or less complex hydraulic machinery, may be omitted. If then the generators are suddenly shut down by a short circuit which opens the circuit breakers, the turbines will race (run up to their free running speed) until the gates are shut by hand. However, generators and turbines must be able to stand this as even by the use of governors the turbines may momentarily run up to their full speed, in case of sudden opening of the load, before the governors can cut off the water. Where this is not desirable, some simple excess speed cut-off may be used.

When eliminating the governing of turbines and running continuously at full load, the question may be raised whether generator ammeters are necessary, as the load is constant and is all the power that the water can give. With synchronous generators, however, the current depends not only on the load but also on the power-factor of the load, and with excessively low power-factor due to wrong excitation the generators may be overheated by excess current, while the power load is well within their capacity. Thus ammeters are necessary with synchronous generators. As soon, however, as we drop the use of synchronous generators and adopt induction generators, the ammeters with their current transformers may be omitted, since the current and its power-factor are definitely fixed by the load. At the same time, synchronizing devices, together with potential transformers, generator voltmeters, etc., become unnecessary. A station voltmeter may be retained for general information but is not necessary, as the voltage and frequency of the induction generator station are fixed by the controlling synchronous main station of the system.

With the adoption of the induction generator the entire exciter plant is eliminated, as the induction generator is excited by lagging currents received from synchronous machines, transmission lines, and cables existing in the system. Thus are dispensed with the exciters, exciter buses, ammeters, voltmeters, alternator field rheostats, etc.; in short, most of the auxiliaries of the present synchronous station become unnecessary.

Thus, **the solution of the problem of the economic development of small water powers is found in the adoption of the induction generator.**

Stripped of all unnecessaries, the smaller hydro-electric station would comprise:

Hydraulic turbines of simplest form, continuously operating at full load, without governors.
Low voltage induction generators directly connected to the turbines.
Step-up transformers directly connected to the induction generators.

High-tension circuit breakers connecting the step-up transformers to the transmission line. In smaller stations, even these may be dispensed with and replaced by disconnecting switches and fuses.

Lightning arrester on the transmission line, where the climatic or topographical location makes these necessary.

A station voltmeter, a totaling ammeter or integrating wattmeter and a frequency indicator may be added for the information of the station attendant, but are not necessary, as voltage, current, output, and frequency are not controlled from the induction generator station, but from the main station, or are determined by the available water supply.

It is interesting to compare this induction generator station lay-out with that of the modern synchronous station. However, it must not be forgotten that **the simplicity of the induction generator station results from the transference of all the functions of excitation, regulation, and control to the main synchronous stations of the system,** and thus the induction generator stations are feasible only as adjuncts to at least one large synchronous station (hydraulic or steam turbine) in the system, but can never replace the present synchronous generator stations in their present field of application.

Automatic Generating Stations.

With the enormous simplification resulting from the use of the induction generator it appears quite feasible to make smaller hydroelectric generating stations entirely automatic, that is, operating without attendance beyond occasional (weekly or daily) inspection.

Such an automatic generating station would comprise a turbine with low-voltage induction generator housed under a shed, and an outdoor step-up transformer conected into the transmission line with time fuses and disconnecting switches.

It is true that in the big synchronous generating stations of thousands of kilowatts, the cost of auxiliaries, such as exciter plant, regulating and controlling devices, etc., is only a small part of the total station cost, and little would therefore be saved by the use of induction generators. No induction generators would, however, be used for such stations. But the cost of auxiliaries and controlling devices, and the cost of the required skilled attendance decrease far less with decreasing station size than that of the generators, whether synchronous or induction, or, in other words, with decreasing size of the station **(per kilowatt output)** the cost of auxiliaries and controlling devices, and of attendance, increases at a far greater rate than that of the generators, and very soon makes the synchronous station of the present type uneconomical.

It is also true that in the big modern hydraulic power systems, the cost of the generating station usually is a small part of the cost of the hydraulic development. Therefore, any saving in the cost of the generating station would be of little influence in determining whether the hydraulic development would be economical. With decreasing size of the water power the cost of the hydraulic development **per kilowatt output** usually increases so rapidly as to very soon make the development of the water power uneconomical, no matter how simple and cheap the station is.

Value of the Induction Generator.

However, the value of the induction generator lies not so much in the reduction of the cost of the generating station as in the reduction of the cost of the hydraulic development, through making it possible to apply to the electric generator the same principle which has made the electric motor economically so successful. **Collect the power electrically just as we distribute it electrically.**

We do not, as in the days of the steam engine, convert the electric power into mechanical power at one place by one big motor and distribute it mechanically by belts and shafts; but we distribute the power electrically, by wires, and convert the electric power to mechanical power, wherever mechanical power is needed, by individual motors throughout mill and factory.

In the same way we must convert the hydraulic, that is, the mechanical power, into electrical power by individual generators located along the streams or water courses within the territory, wherever power is available, and then collect this power electrically by medium-voltage collecting lines and high-voltage transmission lines, and so eliminate most of the cost of the hydraulic development, to solve the problem of the economical utilization of the country's water powers. If we attempt to collect the power mechanically, that is, by hydraulic development which gathers the waters of all the streams and creeks of a territory together into one big station and there converts it into electric power, the cost of the hydraulic development makes it economically hopeless except under unusually favorable conditions where a very large amount of power is available within a limited territory, or where nature has done the work for us in gathering considerable power at a waterfall, etc.

It is the old problem and the old solution: If you want to **do it economically, do it electrically.**

Naturally then, we would use induction generators in these small individual stations, just as we use induction motors in individual motor installations, but, where large power is available, there is the field of the synchronous generator, where the induction generator is undesirable, just as the synchronous motor is preferable where large power is required—unless the synchronous motor is excluded by conditions of starting torque, etc.

At first, and for some time to come, we would not consider going down to sizes of induction generators anywhere near as small as are common in induction motors. However, throughout the country, there are undoubtedly many millions of kilowatts available in water powers which can be collected by induction generator stations from 50 horse power upwards, and which at fair heads, would require no abnormal machine design (no very slow speed).

Consider the instance of a New England river with a descent in its upper course of about 1,100 feet of varying gradient within five miles: at three places where the gradient is steepest, by a few hundred feet of cast-iron pipe and a small dam of 20 to 30 feet length and a few feet height (just enough to cover the pipe intake), an average head of 150 feet can be secured, giving an average of 75 horse power each, or a total of 225 horse power or 170 kilowatts. This would use somewhat less than half the total potential power. The development of the other half, requiring greater length of pipe line or involving lower heads, would be left to meet future demands for additional power.

The installation of an electric system with 170 kilowatts would hardly be worth while; but there are numerous other creeks throughout the territory from which to collect power and which within a few miles pass high potential transmission lines, coming from big synchronous stations into which the power-collecting lines from the induction generator stations could be tied and from which they could be controlled.

Thus, the large modern synchronous station has its field and is about as perfect as we know how to build stations for large concentrated powers; but beyond this there is a vast field and therefore an economic necessity for the development of a different type of hydraulic generating station to collect the scattered water powers of the country, and that is the induction generator station, to which it is desired to draw attention.

Caution must be exercised, however, not to mistake small power and low-head power. There are, on the lower courses of our streams, some hydraulic powers which are relatively

(Concluded on page 38)

Big Japanese Electrical Exhibition

Shows Possible Markets and Competition to be Expected—A Country Wide Awake to After War Needs and Preparing to Meet Them

One of the finest and most creditable exhibits illustrative of any industry in Japan was that lately held at Uyeno Park, Tokyo, by the Japan Electrical Society in commemoration of its twenty-fifth anniversary. To one not acquainted with the rapid progress made in all lines of industry in this country, the exhibtion just closed would come as a surprise. When we remember that up to thirty years ago electric energy was never used in Japan, other than the weak current necessary for telegraph and telephone lines, it is all the more remarkable to witness specimens of almost every known electric device. The use of electricity has become very widespread during the last twenty years, as may be judged by the number of electric-lighting companies in Japan, which in 1915 exceeded 485, using 8,400,000 lamps, or by the number of electric motors in use, which amounted in 1915 to 42,000 in number, developing 182,704 horse-power, and also by the electric tram lines, which totalled 71 in number in 1915, with an aggregate total mileage of over 1,285 miles. During the last three years still greater advancement has been made, but the figures for these years have not as yet been officially announced.

Object of Exhibition.

In 1896 the Japan Electrical Society was formed for the purpose of promoting electrical science and industry. During the last twenty years this society has been very active in its propaganda and has been successful in its aims, so much so that to-day there is hardly a family in any of the cities and towns of Japan which does not know some at least of the many advantages to be derived from electric energy. Furthermore, since the outbreak of war in Europe this society has been able to direct its efforts towards greater progress in peaceful pursuits, while the Allies have been wholly taken up with the affairs of war. It has been this peace footing that has therefore helped the electrical industry of Japan to make sure its foundation of success, and to prepare accordingly for the great competition that will surely break once peace is declared.

With the further intention of strengthening the position of electrical enterprises in this country, the Japan Electrical Society decided to open an extensive electrical exhibition which would embody all the representative branches of the industry.

General Plan of the Exhibit.

From the first announcement of this exhibition, applications poured in from electrical industries all over Japan. In order to give each exhibit sufficient space to make a creditable showing it was decided that it would be best to only allow a limited number of firms to exhibit their goods. The management with this end in view, could only accept the first 227 applications, those who applied late having to be declined on account of lack of space. On the average the allotment to each exhibit amounted to 7 tsubo or about 28 square yards; some of course were much larger and others smaller.

Classification of Exhibits.

The exhibts were divided into thirteen classes, as follows:—

Class 2.—Electro-chemical industry: Electrolysis, electric and utensils, toilet sets, cleaning utensils, stoves and furnaces, laundry appliances and fittings, electric fans, small electric motors, their appliances, electric bells and indicators.

Class 2.—Electro-channel industry: Electrolysis, electric furnaces, machines, apparatus and tools relating thereto, their products.

Class 3.—Electrical communications: Telegraphs, telephones, electric signals, etc.

Class 4.—Electric illuminations: Electric lamps, materials used for the fabrication of lamps, shades and globes; electric illumination appliances, electric advertisements, etc.

Class 5.—Generation and distribution: Generators, transformers, switchboards, conducting wires, cords, connecting appliances, meters, lightning rods, switches.

Class 6.—Application of electric current: Motors and appliances, devices for the application of the electric current.

Class 7.—Electric vehicles: Electric automobiles, aeroplanes, motor-boats.

Class 8.—Electricity and agricultural, mining and fishery industries: Machines used in mining, machines and farm implements used in agriculture, fittings and tackle used in fisheries, etc.

Class 9.—Development of electricity.

Class 10.—Materials used in electric industry.

Class 11.—Electro-physical and chemical apparatus, electric medical appliances: Physical and chemical apparatus, medical and surgical apparatus and appliances.

Class 12—War and electricity: Ordnance, war requisites with the application of electricity.

Class 13.—Government and school exhibits, etc.

Unfortunately these classes were not adhered to very strictly in arranging the layout of the exhibition. Thus we might see a demonstration of cooking utensils in four different buildings mixed up with other varieties of electrical supplies. If each class of goods could have been shown together the exhibition would not have seemed nearly so complicated in the minds of the general public.

A Typical Building.

A typical exhibition was that of a large Japanese electrical and engineering works. Here were demonstrations of the use of electricity as applied to industrial and household work. A large horizontal electric crane was seen travelling up and down. Attached to this was a powerful magnetic lift which demonstrates how iron and steel rails may be picked up and loaded into cars with a magnet. In one corner of the building was a small model of an up-to-date electric shipyard derrick with similar magnetic lift attached. Then again many different kinds of motor and motor machinery such as electrically driven lathes, milling machines, drills, planers, etc., were all in operation for the benefit of the public. In another part of this building was a display of switchboards, together with a model elevator, while in yet another were many kinds of household utilities such as electric heaters, irons, hot water bags, laundry machines, ice-cream freezers, etc.

Electric Stoves.

The first exhibit to be seen in the eastern pavilion was that of an Osaka concern who were showing electric cooking stoves and heaters for household purposes. Most of the stoves shown were intended for Japanese use, being only a

By A. E. Bryan, Canadian Trade Commissioner at Yokohama.

... and a half high, as the Japanese of course, cook sitting on the "tatami" (Japanese floor). There were one or two foreign models on display also. One style with two ovens, and two large and two small cooking plates sold retail for yen 450. Compared to Canadian electric stoves the above model was inferior both in workmanship and in design. It was said that the Japanese have not been able as yet to manufacture electric cooking stoves of the same quality as those of Canadian origin, nevertheless they are to be complimented on the progress they had made in this direction, for the electric stove industry is only in its infancy here. It stands to reason that improvement will be made on cooking stoves, as has been done on other electric devices which are now made to perfection in this country.

Of much interest were the electrified Japanese hibachi which were in display here and in other exhibits. This Japanese stove is really a wooden box or a round bowl-shaped container which is filled with charcoal ashes nearly to the top. In these ashes charcoal is burned and it is upon this that the ordinary Japanese family cooks its meals and secures its heat in cold weather. Instead of the charcoal, the electric hibachi have an electric coil operated on the same principle as are electric toasters. On account of the present high prices of charcoal, the new electric stove ought to prove very popular amongst Japanese families in towns and cities where nearly all have electric light installed in their homes.

Electric Insulators.

Another interesting display in this pavilion was one advertising porcelain insulators; a strong current was made to pass a spark six or eight inches long from brass wires projecting from porcelain insulators which passed in succession under a main wire, illustrating the efficiency of the insulation. The sight of this big spark was very interesting to the public and drew crowds of spectators.

There were many interesting exhibits showing other various kinds of insulating materials made from ebonite, mica, asbestos, caoutchouc, rubber electric cables, marble, etc. Each was represented by a company specializing wholly in that particular insulator. The asbestos booths were particularly interesting in that samples of Canadian asbestos were on view along with Russian, African, and Italian asbestos.

Turbines.

There were many exhibits of turbines of various forms from the ship turbine to the water turbine used in power-houses.

Wire Cables.

What were considered to be the best displays in the whole exhibit were those of the wire cable manufacturers. It is remarkable what Japan has accomplished in this industry. Plain copper wires, copper belts, armoured cables of all descriptions, flexible copper wires, transmission wire, electric bell wire, telephone and telegraph wire, asbestos-covered wires and patent non-sulphur resistant rubber wires were all shown on a most elaborate scale. Japan being one of the greatest copper-producing countries in the world, has everything in its favor for the manufacture of copper wire of all kinds. One or two of the exhibitors had displays of wire arranged according to the countries to which the wire was exported, showing that these firms were shipping electric wire practically all over the world. Most of the wire manufacturers also showed brass products such as piping, tubes, sheets, plates, etc.

Motors and Generators.

There were many splendid displays of electric motors of all kinds. Probably it would be safe to say that there were more motors than any other electrical machinery on exhibit, in one form or another.

Electric Lights.

Three good exhibits of electric light bulbs of various sizes and description were on view, and one company showed the whole process of manufacture from the glass bulb to the finished light. Other firms were showing electric sockets and light fixtures, shades, etc.

Telephone and Telegraph Instruments.

There were six firms showing exhibits of communication apparatus of various kinds, three of which represented telephone manufacturers and three telegraph and wireless telegraph makers. The telephone has been in great demand during the last two years and many have been manufactured. So far the Post and Telegraph Departments, which control the telephone system, have not been able to cope with the demand. In Yokohama this month there were applications for four thousand telephones, while the authorities could only allot some one hundred and fifty new telephones, which are being distributed by a process of drawing by lot—those who draw the right number will get telephones.

The wireless telegraph displays were very well arranged. Not only were there instruments inside of the pavilions, but there was set up outside of the buildings a wireless plant which was sending and receiving messages during the whole of the exhibition.

One is amazed on first arriving in Japan, with the number of wireless outfits that can be seen, when travelling through the country, amateur outfits located in some back-yard perhaps, as Japanese boys take a great interest in wireless telegraphy which accounts in part for its popularity in this country.

Transformers

Eight displays illustrated the transformer industry in this country—from the little common variety that one sees on the telegraph poles up to the large power-house size—eight and ten feet high.

Dry and Wet Batteries and Appliances.

There were seven different displays of batteries—from the pocket flash light variety to the large storage batteries used for lighting automobiles, houses, etc. Pocket flash lights of different varieties were usually on display also.

Miscellaneous Electric Devices.

Other interesting displays were staged representing the following: Automatic signals for electric cars, motor fans, laundry machines, electric furnaces for baking china and porcelain ware, elecric volt motors, tachometers, speed indicators, electric pumps, electric rice cleaning mills, magnetos, electric automobiles, electric clocks and electric pumps of every description.

Electric Railway Models.

Besides the models of electric cars which were shown illustrating their mechanical workings, etc., the Imperial Government Railways had a very attractive exhibit showing dining, sleeping and other cars, as used on their lines. There was also on display the first street car ever run on the streets of Tokyo.

Surgical and Medical Supplies

Modelled after German designs, the exhibits of surgical and medical apparatus presented a very attractive appearance. There were in all eight companies represented in this class. To the layman the X-rays and various massage instruments and healing appliances all looked to be equal of those seen in other countries.

University Exhibits.

Besides those displays shown by each individual manufacturer, the universities of Japan each contributed a booth

where some particular electric device as used for the instruction of students, was shown. Thus the Waseda University were exhibiting a vacuum discharge apparatus, the Imperial University sets of anemometers, direct current dynamos, high tension insulators, and electro-therapeutic machines, etc., while the Tokyo Technical School had on view a three-horse power reduction motor, besides transformers, etc.

Government Exhibits.

The various departments of the Japanese Government displayed very interesting examples of the utility of electricity.

The Naval Department had on view a very powerful search-light such as is used on warships. A late model of an anti-aircraft gun was also demonstrated with particular reference to the electric motor controlling its movements. The War Department showed some up-to-date army wireless outfits together with telescopic searchlights, etc. The Department of Communications exhibited various kinds of telegraph instruments, wireless apparatus and fittings therefor.

The Korean Government had an exhibit showing the kind of telegraph and telephone system in vogue in that country. While the Imperial Government Railway of Japan and the Manchurian Railway Company each has interesting exhibits of passenger cars as used on these railways, and showed also the illuminating systems therein.

Associate Electrical Products.

There were also some fine exhibits of products made by the use of electricity or articles used in addition to electricity for the manufacture of some other commodities. Five exhibits illustrated the calcium carbide industry, the carbide was shown packed ready for shipment in steel drums which were inserted in a wooden case. Electric steel made in Japan was exhibited by five different companies. Carbon electrodes from the smallest to the largest sizes were on view in three different booths—other products which attracted one on passing through the various pavilions were—carbon brushes, caustic soda, bleaching powder, potassium chloride, electro-chemistry apparatus, ferrochrome and ferro-silicon, ammonium sulphate, zinc paints, electric soldering machines, cement, metallic tungsten and oxides, antimony, electric hair dressing requisites, and electro-plated wares such as cutlery of all kinds, spectacle frames, etc. An electric incubator was also demonstrating its ability to hatch out young chickens before the eyes of many eager onlookers.

Model of Hydro-Electric Power Plant.

Probably the best arranged demonstration of any seen at this exhibtion, as well as the most creditable to the management, was the modelled hydro-electric system which was built up on one side of the exhibition grounds.

An artificial mountain fifty feet high, the foundation of which covered about 3,540 square yards of land, was built up with structural timbers, and covered with soil, rocks, turf, trees and flowers in order to give it the appearance of a real mountain, with all its natural appearances. Along the top of this structure and at a slight decline ran an artificial river, the head of which was really supplied with water by a motor and pump, but the scenic effects of which gave the appearance of a great lake out of which the stream wound its way among rocks and ravines, all very natural in appearance, to the head of the pipe that took it down to the turbine or horizontal water wheel of Pelton tpye, constructed by one of the exhibitors, and which developed a force of 150 horse-power. This water wheel was constructed with glass sides so that the spectators could see the inward workings of the machine. There was a dynamo connected with this water wheel, and the electricity generated was then transformed by means of three transformers to a higher tension and distributed throughout the exhibition grounds to supply the current needed for the many lights, search-lights, etc., which were lit up in the evenings.

Over this mountain and through the grounds high voltage wires were carried on steel frames, very similar to those in use by the Ontario Hydro-Electric Commission, but which were entirely constructed in this country.

A tunnel eighty-four feet in length ran through the centre of this artificial mountain, and inside of which were scenes depicting actual conditions of warfare on the Western Front. There were also paintings by a famous Japanese artist.

Electric Searchlights.

Each evening after dark a battery of thirteen powerful searchlights situated on the top of the north pavilion, which were provided by the Naval Department, would play on the surrounding country and cast great streams of light on the sky and on the lake Shinobozu. This was a unique sight for the public of Tokyo and was very attractive.

Model Suite.

One exhibit which proved very popular was the model Japanese suite of five or six rooms fitted up with all the possible electrical fittings that could be applied to a house, such as electric stove, kettle, fan, lights, bath-tub heater, toasters, irons, etc. This served as a demonstration for the Japanese public in making their house comfortable and at the same time was an advertising medium.

Reinforced Concrete Appliances.

One firm had a very interesting exhibit of concrete products as applied to electrical conveniences. A few samples of concrete double-track trolley line poles were on view, while there were also railway sleepers made of reinforced concrete.

Tokyo Educational Association.

This association had a booth fixed up in the form of a laboratory where there were about twelve microscopes as well as many different kinds of electrical toys and novelties such as buzzers and shockers, which the general public were privileged to use.

Why Not Conserve Jitney Gasoline?

While we have no fault to find with the fuel administrator for establishing chugless Sundays if the needs of the government for gasoline require them, and we accept his word for this, we invite his attention to another way in which he can stop the unnecessary use of a large amount of gasoline. We refer to the suppression of jitneys, for whose waste of gasoline, rubber, and lubricating oil, all necessary to our military forces, there is no economic excuse. Such action by the fuel administrator would correct a manifest evil so far as the consumption of these war essentials is concerned, and would also release to the essential industries of the country or to actual war service the men who drive these cars and the mechanics who keep them in repair. Electric cars are common carriers and have to run, and where an electric line is parallel to jitney service it can furnish all the transportation needed both on Sundays and on other days.—Electric Railway Journal.

Don't allow your Thanksgiving Holiday to interfere with your plans for attending the Goodwin banquet on Tuesday night.

Detailed Description of Recently Installed 45,000 kw. Turbine-Generators

By J. P. Rigsby*

The 45,000 kw. turbo-generator unit recently put into operation in the power station of the Narragansett Electric Light Company at Providence, R.I., is of the now well-known Westinghouse cross-compound, double unit type, consisting of a high and low pressure turbine, each connected through a flexible coupling to its own generator, having a capacity of 23,500 kw., and mounted on separate bedplates supported on foundations lying parallel to each other. The generators are arranged to feed separately or together to the main bus.

This type of turbine is very successfully exemplified by the three 30,000 kw. units installed a few years ago in the 74th Street Station of the Interboro Rapid Transit Company, New York. Steam enters the high pressure turbine through suitable governor-controlled valves, passes through this single flow element, and out through an exhaust on the top, and is conducted by means of a receiver pipe overhead to the middle of the double flow low pressure turbine alongside, where it divides, flowing in opposite directions through low pressure blading, then down through the exhaust chambers into two Westinghouse Leblanc jet condensers of the latest type.

The energy given by the steam at full load is equally divided between the high and low pressure turbines, the generators dividing the load in half; at lower loads a greater proportion is carried by the high pressure element.

The unit was designed to operate with a steam pressure at the throttle of 200 pounds with 100 deg. superheat and a vacuum of 29 inches in the exhaust, while the generators have a capacity of 23,750 kva., 11,000 volts, 3 phase, 60 cycles at 0.95 factor, the high pressure element having a speed of 1,800 r.p.m., and the low pressure 1,200 r.p.m.

There are four bearings to each unit, a flexible pin type coupling being used to connect the turbine and generator.

The high pressure turbine is of the single flow reaction type throughout, of a very simple, rugged construction, designed for efficiency and dependability, all parts coming in contact with high pressure steam being made of cast steel, while the exhaust chamber and other parts not subjected to high temperature stresses are of cast iron.

The pressure in the high pressure cylinder varies from a maximum of about 200 pounds at the inlet to atmospheric pressure in the receiver pipe at full load.

With the reaction type machine, high pressure steam is admitted, of course, direct to the cylinder casing instead of into nozzle chambers, as is the case with an impulse type. This presents the problem of perfecting a horizontal joint on a cylinder of considerable diameter that will be tight, and stay tight, against 200 to 300 pounds steam pressure, or any tendency to open, due to distortions from the high temperature.

The high pressure end, or steel part of the cylinder, is composed of two steel castings, 5 feet 10 inches inside diameter and 1¾ inches thick, while at the joint the thickness gradually increases until it merges into a flange eight inches wide, tapering to the outer edge. The bolts 2¼ inches in diameter are spaced about one-third of the way from the inside edge, and four inches between centers. These bolts, or studs, as they really are, are tapped alternately into upper and lower flanges registering with suitable bosses on the companion flange. This method permits of a closer spacing of bolts, removing less metal, and produces a stronger flange than by any other means. No gasket is used, the joint being scraped to a surface.

The four rings containing the blades are not an integral part of the main cylinder, but are made of separate castings jointed in the middle, resulting in simplicity of construction, freedom from strains, and the absence of those difficulties inherent in a complicated steel casting, besides being a distinct aid in manufacturing as the machine work is not all done on one piece, but can be divided among different machines, and finally assembled when each piece is completed. These rings are clamped in place, again saving expensive work on the main castings.

The high pressure cylinder is supported on three points, as usual, one under the governor, or thrust end, and one on each side of the exhaust, near the center line, thus insuring against distortions, or a possibility of misalignment, due to differential expansions between the turbine and generator supports from unequal temperatures.

The high pressure spindle consists of a hollow steel drum about three feet in diameter, carrying most of the blading, there being two blade rings of larger diameter on the one end, and corresponding dummy rings, or balance pistons, on the other. The spindle ends are pressed into the drum and are secured with tee-headed shrink links, which are held in place by the blade and dummy rings.

The stresses in the spindle parts are quite low, these parts being made from ordinary carbon steel. However, strict care is taken in making the castings in order to insure homogeneity, the precautions necessary to secure this uniformity having been learned by long experience.

There are 24 rows of blades in the high pressure turbine, ranging in size from one inch blades, 4 inches long, to 1¼ inch blades, 9½ inches long. These blades are unusually strong and rugged, and they insure the highest efficiency and durability. The maximum mean blade speed is 470 feet per second.

The steam passes out through an exhaust at the top of the cylinder into a 66-inch receiver pipe leading over to the low pressure turbine. A similar exhaust is provided directly below, which connects through an automatic relief valve to the atmosphere.

A gate valve is placed in the receiver pipe, in case it is necessary to operate either turbine alone, the high pressure turbine running non-condensing, under control of its own governor, or the low pressure turbine, on steam admitted through a 14-inch throttle from the high pressure line, it being connected in step electrically with some other unit in the system.

Flexibility on the Steam Line.

Steam is supplied to the unit through a 24-inch header, every care being taken to provide adequate flexibility to the line. A standard Westinghouse type throttle valve with the regular automatic stop features controls the admission. The throttle valve steam strainer and primary steam chest, which are located adjacent to the bedplate alongside the turbine, are spring-mounted, so as not to impose a dead load on the cylinder.

The low pressure element is of the straight double flow reaction type. The steam entering at the top through the above mentioned receiver pipe, passes around the spindle in an annular chamber of ample proportions, and enters the low pressure blading, there being eight rows in each end, ranging

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from ¾-inch blades, 6 inches long, to 1¼-inch blades, 18 inches long.

The low pressure cylinder rests on four supports applied near the centre line on each side of the exhaust chambers. It is free to expand axially, sliding on these supports, the turbine being anchored to the inboard generator pedestal. A system of radial and axial stays in the exhaust chamber produces extreme rigidity, minimizing the possibility of distortion, or sympathetic vibrations.

The low pressure spindle is composed of a central drum, rigidly secured to the spindle ends. Upon each of these ends are mounted two discs carrying the low pressure blades, the maximum mean velocity of which is only 515 feet per second, which precludes the necessity of using other than a reasonably good grade of cast steel in the blade rings. However, owing to the double flow feature, ample blade area is provided to make the best use of a high vacuum and still maintain a conservative blade length in the last rows. Phosphor bronze blades are used throughout, except the last three rows in the low pressure, which are forged steel.

The low pressure cylinder is entirely of cast iron, composed of a center section and two end sections, bolted and spigoted together, and all split horizontally. The three upper pieces are handled as one, the vertical joints never being disturbed.

The high pressure steam admission is controlled much the same as on all other Westinghouse machines, by means of a powerful, though sensitive, governor, which operates the plunger of an oil relay attached to a floating cylinder mounted on the side of the first, or primary valve. This cylinder by means of levers, controls the primary, secondary and tertiary admission valves. The primary valve, located on the side, admits steam to the bottom of the high pressure cylinder, while the secondary and tertiary valves, being located on the top, systematically about the center line, admit steam to the second, or third stage, as the case may be. Loads of 30,000 40,000, and 50,000 kw. respectively, can actually be carried on these valves.

The bearings employed on this unit are carefully proportioned to preserve a satisfactory ratio between unit pressure and peripheral speed. They are lined with genuine babbit metal, supported on sperical seats, and provided with positive adjustment in any direction. A liberal supply of oil is distributed through a groove along the top, while the sides of the bearings are eccentrically relieved for a distance of 35 to 40 degrees above, and below the center line. This leaves an arc of 100 to 110 degrees on which the journal actually rests.

Both turbines are equipped with double Kingsbury thrust bearings capable of taking the load in either direction, though when running under load the thrust is toward the generator. Under normal operation they are loaded to about 300 pounds per square inch, but are capable of safely carrying twice as much. The maximum peripheral speed is about 100 feet per second. These bearings are not only immersed in oil, but they are supplied with a circulation of fresh oil through passages which deliver it near the centre.

The shafts are sealed with the usual well-known water gland with the addition of an annular steam chamber for the admission of steam so that vacuum can be established before starting up. Water is turned on when the turbine approaches full speed and the steam is turned off. One feature of these glands is that they can be removed for inspection without lifting the cylinder cover.

Each turbine is provided with an oil pump sufficient for its own needs, though both feed into the same oiling system. They are double plunger pumps, running at 165 strokes a minute, with a common suction, but separate discharge.

The high pressure oil necessary to operate the steam inlet valves is taken from one side of the pump on the high pressure turbine, pressure being maintained by a spring loaded relief valve. The total amount of oil used is aproximately 175 gallons a minute. The bearing oil pressure is from five to eight pounds.

This unit, although it does not consist of two separate elements, is started the same as any other machine. Field excitation is supplied to the generators, the throttle on the high-pressure element is opened, and slowly brought up to speed, the low pressure generator operating as a motor, and coming to speed in step with the other. The two machines as a unit can then be synchronized, and placed on the line, remaining in step, and properly dividing their load.

Largest Condenser in the World.

The condenser equipment for the above turbine consists of the largest condensing apparatus in the world. The condenser unit is composed of two separate and distinct low level jet condensers, which can be operated together, or separately, if necessary. If the temperature of the injection water is low enough to warrant it, the operation of only one condenser is necessary to maintain a workable vacuum.

These condensers are connected to form a single condensing apparatus by means of an exhaust connection, ample

Sign Peace at Potsdam

The war will change very suddenly from the appearance of a close-drawn struggle to an absolute German surrender. . . There are three absolutely essential conditions to a satisfactory peace.

The first is that Germany shall be invaded. Too long has she been led to suppose that she is inviolate. This delusion must be shattered.

The second is the occupation of Berlin and the signing of peace at Potsdam, in the very hall in which the plot was hatched.

The third and most important of all is that Germany must pay to the last penny the expenses her outrageous conduct has cost the allies.

This is both policy and justice. She can prepare no other war while she has such a debt, and she will need no army or navy. In 1915 she planned to exact four thousand millions from France alone.

Revolution could only bring the Social Democrats to the top. These people have, with a small minority, in the main sustained the German attack upon her neighbors. We owe them no consideration. Whoever rules Germany inherits the fruits of her criminal conspiracy against the world.

—Sir Conan Doyle.

to allow to permit operating either condenser alone, when necessary.

The same water level is maintained in each condenser by the use of a water equalizing connection between one pump body and the other. This is an absolutely necessary feature and it is provided in order to maintain a constant submergence over the center line of each pump, to provide sufficient head to force water into the runner under vacuum. This water equalizing connection is so constructed that no surges occur between the condensers, it being made in the form of a tee, the bottom of which forms a reservoir. A baffle running almost to the bottom prevents surging.

An air equalizing connection is provided to maintain the same air pressure in each condenser. If both are in operation, the valve may be either open or closed, but it has been found by trial that if one condenser, only, is in operation, the valve must be open in order to have the same air pressure in each.

The condensers are equipped with geared turbine driven pumps running at 500 r.m.p. instead of 700 r.m.p., which latter is standard. This was found necessary, owing to the limited headroom in the basement. These pumps are able to operate with a submergence of 50 inches above the center line of the pump shaft, while 72 inches is necessary with a 700 r.p.m. pump. This resulted in a saving in headroom of 22 inches.

Considering capacity, this unit requires less floor space than any other condenser unit now in operation.

In starting up this condenser it is necessary to use a priming pump. The main turbine is operated non-condensing, or with a slight vacuum, until sufficient vacuum is obtained for the condenser to lift its own water.

The operating company has found it convenient in winter time, when the temperature of the injection water is very low, to operate only one condenser of the twin outfit, and still maintain the vacuum desired, thereby cutting the cost of operation in half. In cutting the condensers out, it is only necessary to close the discharge and injection valves to the condenser not in operation and to operate the other independently.

As a matter of interest, it may be well to note that the above concern uses nothing but jet condensers. Its experience has been that while the boiler feed water is expensive, nevertheless, surface condensers do not stand up under the extremely bad water conditions existing at Providence, and it is necessary to employ jet condensers.

The twin condensers used with the above 45,000 kw. turbine require 18,000,000 pounds of condensing water per hour, 9,000,000 pounds in each condenser. In addition to this 15% more is required for the operation of the air pump.

New York Subway Extension

The New York subway extension system represents the world's greatest achievement in electric railway construction. It consists of 619 miles of track, serves four of the five boroughs of the city and has a capacity of three billion passengers per annum. New York, after five years of construction work and the expenditure of $400,000,000, has completed and put into operation the greater part of her new system of radid transit, known as the Dual System, because the Interborough Rapid Transit Co. and the Brooklyn Rapid Transit Co. have co-operated with the city in developing it.

Four parallel elevated lines and a subway constituted the former rapid transit system in Manhattan. The subway started in Brooklyn, ran north through the eastern part of Manhattan as far as 42nd street, west on 42nd street to Broadway, and then north through the western part of the city, thus forming the so-called "Z." In the new system the eastern part of the old subway has been continued south, thus forming two parallel and independent subways with a shuttle connection under 42nd street. This arrangement is known as the "H." The eastern branch uses the old Brooklyn tunnel, while the western will later on enter Brooklyn through a new tunnel. These two subways are operated by the Interborough Rapid Transit Company. A third subway is operated by the New York Municipal Corporation formed by the Brooklyn Rapid Transit Co. This subway was built between two Interborough subways, which will eventually start in Brooklyn, pass under Broadway, Manhattan, and run over the Queensborough Bridge, at 59th Street, into Queens. In addition, a fourth subway, operated by the Interborough, connects with the old subway at Grand Central Station, and runs through the Steinway tunnel to Long Island City and from thence into Queens. By the extensions vast areas have now for the first time rapid transit and easily accessible to the heart of the city.

Thus the railway mileage of New York has been more than doubled, and it has the most extensive subway system in the world, comprising as it does more than two hundred miles of under-ground railway. Some of the subway routes which honeycombed the soil of the great metropolis has necessitated the boring of tubes under the East river, at an enoromus cost, and under difficulties which would seem to require almost superhuman endeavor.

Nor is the whole story of the efforts to solve the traffic congestion problem of New York been told. Third tracks have been added to the elevated railways on which express service is provided during the rush hours, while instead of one subway there are now three with express service all day. Hence it is no exaggeration to say that the transportation facilities have been increased five fold in down-town Manhattan and three fold elsewhere.

It is hoped that congestion will now be relieved at least for a few years. But no growing city can ever solve the congestion problem, for when new facilities are provided the

(Continued on page 38.)

Canada's Plain Duty

Canada is calling on her people to over-subscribe the Victory Loan of 1918 as an imperative duty that cannot and must not be shirked. The reasons are plain to every business man.

Great Britain, having borne tremendous burdens, naturally finds it difficult to finance her war purchases in this country. The United States is perfecting a vast war machine and her financial resources are required for that purpose. It is necessary, therefore, that Canada should raise within her borders the funds required, not only to carry on our normal and war activities, but also to advance substantial sums to Great Britain if we expect her to continue her purchases here.

Canadians have not been asked to subscribe a war loan since November, 1917, nearly a year. This is an advantage in every way. The long respite has enabled the 1917 Victory Loan to be splendidly absorbed and distributed, and allowed business to proceed without the temporary halt which war loan issues always bring.

The maintenance of the market price of the 1917 Victory Loan at the issue price and even higher, shows the gilt edged nature of the security and furnishes a record in war finance. Their purchase is a duty; a duty that ensures profit.

BUY VICTORY BONDS.

One-Man Car Possibilities for Economy

A special issue of the Electric Railway Journal is given over largely to a discussion of the "economy" side of electric railway operation and in this connection considerable space is given to the one-man or safety car. In a number of cities, both in Canada and the United States, critical situations have been saved by the adoption of this type of car which is alike economical of men, power and maintenance. So far as Canada is concerned it seems to be chiefly the opposition of the operators themselves that has prevented the more general use of this type of car—the chief objection being that men will be thrown out of employment. In these days of labor shortage this does not appeal to us as an argument against nearly so much as in favor of safety cars.

Among other interesting articles in the issue mentioned is one by Mr. John A. Beeler, consulting engineer of New York, in which he makes an analysis of one-man car possibilities.

Of available operating economies the modern lightweight one-man car with automatic equipment is most important in the extent of its applications, in the largeness of its savings and above all in the fact that it increases travel.

By "extent of its applications" is meant all the service in practically all communities of 75,000 or less; a large part of the service in cities of the middle size, and service on such lines of metropolitan cities as are not routed over the more congested streets.

By "largeness of its savings" is meant the reduction in power and platform expense aside from economies in track and car upkeep.

"By "the fact that it increases travel" is meant the stimulation of traffic through increased service, which has had the twofold effect of eliminating automobile competition and of encouraging short as well as long rides.

In a City Below 100,000.

Let us consider the modern one-man car as applied to a specific case, say a city of less than 100,000. The community is served by 25 miles of single track. It should be a splendid electric railway town because of hills which are responsible for grades up to 10 per cent. Slow schedules, bad track, poor cars and two-man crews, however, have made the cost of operation equal 90 per cent of the gross revenues. That the town itself is prospering is indicated by the fact that the car-mile earnings rose from 20 cents in 1911 to 22.5 cents in 1916, with a further rise to 24.5 cents in 1917. Yet the small passenger earnings of $1.66 per car-hour (due largely to slow schedules) and average annual earnings of but $5 per capita indicate that the riding possibilities of this city are far from exhausted.

The reasons why the maximum riding possibilities have not been attained might be classified as follows:

1. Unsatisfactory routing and headways.
2. Low speeds.
3. Unattractive cars.
4. Financial impossibility of increasing service, in view of the low number of miles per man and car, excessive energy consumption and high maintenance.

Re-routing Offers Big Savings in Time.

Ordinarily the first thought in connection with improving service is to shorten the headways; the second is to raise the schedule speed, and the third (if considered at all) is to improve the routing. Yet in the present case re-routing was the most important factor.

Analysis showed that lines Nos. 1, 2 and 3 were satisfactory as to routing, since they brought the passenger directly to the business centre. Line No. 4 not only passed at some distance from the centre, but was also at the bottom of a steep hill. It is true that a transfer to the centre was obtainable, but transfers are an inconvenience at best. This circumstance, plus a ten-minute headway, doubtless tempted persons who lived a mile or two along this line from the business centre to walk instead of ride.

The remaining three lines, Nos. 5, 6 and 7, did not reach the business centre directly, but relied on transfers. The headways on these lines varied from ten to twenty-five minutes. Since the one-way trip length of line No. 5 was 2 miles and of Line No. 7 only 1¼ miles, it is obvious that people in their vicinity could not save much time by riding. As far as crosstown riding was concerned, three and even four transfers might be necessary to ride an equal number of miles!

Hence the basic recommendation was to route all of the lines via the centre of the city so that riding would be encouraged by minimizing walking and transfers. To put the matter in another way: Five minutes saved a person in waiting for a connection or in walking from an offside line is in effect almost as good as cutting a ten-minute headway to a five-minute headway.

As this re-routing was considered in connection with one-man car operation, it is proper to mention that the concentration of all lines in the business section would be well below the saturation point for this character of operation. The averaged combined headway would still be only two minutes, compared with less than one minute in cities where such cars are now in use.

The railway was found to be using summer and winter sets of rolling stock. The open cars were of ten-bench capacity, while the closed cars were of one-man car size, as they seated only thirty to thirty-two passengers each. Because of the duplication and age of the equipment only 40 per cent of the rolling stock, including trippers, was in use on any one day.

Energy consumption was high, ranging from 2.5 kw. hr. per car-mile in summer to 3.75 kw.-hr. per car-mile in winter for cars averaging 25,000 lb. loaded. Thus while the cars were not so heavy as the over-sized cars of other properties, their age and antiquated design were figured as responsible for 200 watt-hours rather than the 125 watt-hours per ton-mile possible with modern, faster one-man cars over the grades of this city. Yet the old schedule speed averaged only 7.5 m.p.h. or little more than twice walking speed. The cost of car maintenance was 2.5 cents per mile.

To supersede this service the one-man safety car, which has since become increasingly popular, was recommended. Under the conditions then obtaining this would have reduced platform expense from 35 per cent to 18 per cent of passenger receipts after allowing a 3 cent differential in wages—an annual saving of nearly $50,000. It would also have reduced energy consumption (the use of thermostats and coasting recorders being assumed) from 15 per cent to 8 per cent of passenger receipts by cutting the cost per car-mile in half—an annual saving of $20,000.

Other possibilities of the one-man safety car in promoting economy and increasing travel will be noted in the following anaylsis of several re-routings:

In the case of two lines the present direct routing and the ten-minute headway were to be unchanged, but the round-trip running time was to be reduced from forty minutes to thirty-five minutes, so that seven cars would do the

work of eight. In light hours the round trip could be made in thirty minutes, with six cars instead of eight, or six men in place of sixteen.

A third line was to be lengthened from 4 miles to 6.5 miles, round trip, by being extended to the business centre. Theoretically the headway was to be ten minutes as before, but actually the overlapping of another line (also on a ten-minute headway) would give the downtown part of the line a five-minute service, thus helping to draw the pedestrian off the sidewalk. The new schedule speed on his line would be 10 m.p.h. instead of 8 m.p.h.

The remaining lines were recommended to be so combined for through operation that on part of the route a twenty-minute headway per line would give a combination headway of ten minutes, while overlapping further downtown would give a two and five-tenths minute service that only a miser could withstand.

To go into further descriptions of the re-routings would lead to needless complexity. In general it was apparent that on the basis of lower operating costs alone it would pay to change over to one-man safety-car operation over the re-routed tracks without making any allowance for those increases in travel and popularity that have been noted in so many communities.

Bell Telephone Changes

Changes in the Bell Telephone Co.'s organization, effective October 1st, are announced. The Eastern Division, which hitherto has comprised Quebec on the East, to Gananoque on the West, has been extended westward to take in Belleville, Kingston, Napanee, Picton, Tweed and contiguous territory. Over this division Mr. R. F. Jones will continue to preside as Division Manager, and his division superintendents will be Messrs. R. Neilson and F. G. Webber, of Montreal, and J. E. Macpherson, of Ottawa. Mr. L. Belcourt, formerly district superintendent at Quebec, becomes manager at Quebec city, and Mr. W. J. Cairns, whose headquarters were until recently were at Brockville, becomes manager at Ottawa.

In the Western Division, extending from Trenton westward to Windsor and Sault Ste. Marie, Mr. K. J. Dunstan of Toronto will continue as Division Manager, assisted by Mr. A. T. Smith, Toronto, as Division Superintendent, and Messrs. R. Burrows, F. Kennedy, R. Hamilton (Hamilton), and J. L. Richmond (London) as District Superintendents

Important changes in the organization of the plant department also go into effect October 1st. Mr. O. E. Stanton of Toronto becomes Eastern Division Plant Superintendent, with headquarters at Montreal, while Mr. J. H. Martin, of Hamilton, becomes Western Division Plant Superintendent.

In the Traffic Department of the Company, Mr. J. N. Groleau is appointed Eastern Division Traffic Superintendent, and Mr. A. G. Watson, Traffic Superintendent of the Western Division.

Norwegian Government Adopts Electric Trucks

By A. Jackson Marshall

After careful investigation the Norwegian Government have placed initial orders with American manufacturers for fifty heavy electric trucks to be used in various communities for the distribution of food, which, in Norway, as elsewhere, is none too plentiful these days, and which must not only be economically used, but must be also scientifically distributed to avoid waste and spoilage, and to assure minimum transportation costs.

Norway, in common with many other European countries, is faced with a gasoline famine, the fluid, when procurable, costing about $1.00 per gallon. Here the horse, as elsewhere, has ceased to be an economic asset, at least in ordinary commercial applications. It is estimated that to feed a horse with grain for one year requires five acres of land, sufficient to support about eight persons. When in addition to such extravagant use of productive land, horse feed must be freighted vast distances across land and sea, using ship tonnage which is other wise urgently required, the horse must necessarily be relegated to the "non-useful occupation" class.

The electric vehicle is the solution to these problems. Water powers are plentiful in Norway, and, as a result, current, for electric vehicle charging, is available in large quantities at small cost. The electric vehicle successfully competed with the "gas" car when gasoline cost fifteen cents a gallon, and current five and more, cents per kilowatt hour. The superiority of the "electric" in Norway is evident. Besides, the electric vehicle possesses the advantages of not requiring skilled mechanical operators,—its simple control enabling it to be successfully operated by older men and women, not required or suitable for direct war duties, and who, as a class, work for minimum wages. Also the "electric" is very seldom out of repair, and consequently does not require that degree of mechanical supervision and repair necessary to keep gasoline trucks in service. Many Norwegian cities have adopted electric vehicles, large orders being placed with U. S. manufacturers. Electric trucks are also being successfully operated by a number of commercial concerns; and demands for electric passenger cars are said to be in excess of shipping facilities.

Personals

Mr. W. J. Cairns, former district superintendent of the Bell Telephone Company, Ottawa, Ont., has been appointed local manager, succeeding Mr. J. E. MacPherson.

Mr. R. A. Sara has resigned as Sales Manager of the City of Winnipeg Light and Power Department, to accept a position with the American Cellulose and Chemical Manufacturing Company of New York.

Mr. J. E. MacPherson, former local manager of the Bell Telephone Company at Ottawa, Ont., has been appointed general superintendent of the company's lines and exchanges in Ottawa district.

Mr. R. V. Slavin has been appointed to succeed Mr. R. A. Sara as Sales Manager of the City of Winnipeg Light and Power Department. Mr. Slavin is a graduate of McGill University, 1910, and has been connected with Winnipeg's municipal plant since the designing and construction days.

Mr. Tetsutaro Morishima, of Tokyo, Japan, electrical engineer to the Japanese Imperial Government Railways, is at present making a tour through Canada and visiting a number of the more important power plants, with a view to obtaining information regarding the power development work in this country.

Mr. E. N. Hyde has resigned his position as general supplies sales manager of the Northern Electric Co., Montreal, and is returning to Philadelphia. Mr. Hyde has made many friends in Canada, where he has long been recognized as one of the foremost exponents of correct lighting. Both by his writings and letters he has done splendid work in advancing the standard of electrical illumination.

Turkey is scarce. Why not postpone your Thanksgiving dinner until Tuesday night and join the Goodwin banqueters at the King Edward at 6.30?

The Dealer and Contractor

Second Annual Meeting of British Columbia Association of Electrical Contractors and Dealers Held in Victoria a Great Success

On September 13 and 14 the British Columbia Association of Electrical Contractors and Dealers held a very successful annual meeting at Victoria, B.C. The Vancouver members and their friends left by the morning boat for Victoria and were met at the C. P. R. wharf by the Victoria members and the visiting delegates from Portland and Seattle. Headquarters were at the Empress Hotel, from whence a trip by motors was taken to the Observatory. On arrival at the Observatory they were introduced to Dr. Plaskett, who gave them a very interesting account of the greatest telescope in the world and its workings, explaining in detail and by movement of the great tube and its parts, the extent and purpose of the work.

From the Observatory the party motored to the Brentwood Plant of the B.C.E.R. Company, inspecting it under the guidance of Mr. Halls, the sales manager. An excellent supper was then in order at the Brentwood Hotel. The toastmaster, Mr. E. C. Hayward, of Victoria, carried out his duties in his usual efficient way. Mr. Halls gave the visitors to Vancouver Island an address of welcome. He explained that Mr. Goward, local manager of the company, had been called away to Vancouver on business, much to the latter's regret. Songs and choruses were then indulged in, closing with the National Anthems of the Allies. The B.C.E. Railway Company kindly provided a special car for the return to Victoria.

Next morning saw a large gathering assembled in the Empress Hotel for the business meeting. The election of officers resulted as follows: E. Bretell, Vancouver, president; C. Moulton, New Westminster, first vice-president; W. Richardson, Vancouver, second vice-president; P. F. Letts, Vancouver, third vice-president; E. C. Hayward, Victoria, vice-president for Victoria Chapter.

As a recognition of the excellent work performed by the retiring president, Mr. C, H. E. Williams, during his more than two years of office, he received the grateful thanks of the Association and was appointed ex-officio member of the executive committee for the ensuing year. Mr. James Angus, retiring from business in Vancouver and moving to California, was granted permission to resign his membership, receiving the cordial thanks of the members for the excellent services he had rendered as a member. In replying he stated that he would perform "missionary" work in California, with the purpose of inducing electrical men everywhere to join similar associations. In order to assist him in the good work he was elected an honorary life member of the Association.

Then followed a lengthy and earnest discussion on affiliation with the National Association, in which the visiting delegates took part. The result was that affiliation was decided on, to date from the 1st of October, 1918.

This meeting was followed by a luncheon at which the speaker of the day, Mr. R. F. Hayward, general manager, Western Power Company of Canada, gave a very forceful and interesting address, in which he spoke of the progress and possibilities of electricity, its great developments during the war and the greater expected developments after the war. He emphasized the necessity of following the great example of Marshal Foch who set himself an "objective," or goal, to secure. An enjoyable launch trip up the Gorge, with refreshments at the Japanese Tea Gardens, terminated a very successful gathering.

The B.C.E. Railway Company paid a very graceful compliment to the electrical visitors in causing the stately Parliament Buildings to be electrically illuminated both nights.

The visiting delegates, Messrs. Jaggers and Sroufe, from Portland, and NePage, Van Riper, Cooley, and Worth, from Seattle, in addition to being of great social value, were of great help to the Association in clearing up many points in connection with affiliation with the National Association.

Specially gratifying features of the attendance were the large representation from the wholesale houses, every firm being well represented; the goodly number of electrical inspectors and the presence of electrical visitors from distant cities, such as Mr. Fulton from Montreal, and Mr. Rowe from Penticton.

At the conclusion of the business meeting, wires were despatched, announcing the affiliation with the National Association, to the Chairman of the National Association and to Messrs. Kenneth A. McIntyre, president of the Toronto Association, and Mr. Wm. L. Goodwin, originator of the Goodwin plan.

How You Should Keep Stock on the Move

By R. F. Behan*

In order to conduct a profitable business sucessfully it is necessary to learn how long different kinds of articles are kept in stock before they are sold. This knowledge is important both from the standpoint of learning how much of the overhead, such as taxes, rent, insurance and other fixed items should be charged against articles carried in stock, as well as to know how often the capital invested in an article is turned over and how often a profit is taken. From this we can learn the percentage profit earned in a year on the capital represented in an article.

All business is done at some rate per month or per year, varying somewhat according to conditions. A careful study of the time that articles are held in stock will have the effect of reducing the amount of stock to the minimum necessary to take care of the business successfully; whereas lack of such study will result in carrying too big a stock with out-of-date articles and considerable deterioration, as well as an undue overhead charge to take care of this slow stock. A dealer of course should always take into consideration in ordering his stock the question of delayed delivery and the distance of the source of supply, the greater the distance

* In Contact

the greater the handicap in this respect and, of necessity, the larger the stock supplied.

Assume for example that you sell $100.00 worth of heating appliances which cost you $70.00, your gross profits would then be $30.00, or approximately 30 per cent of the gross sale. If you can increase your rate of doing business so that you can sell this quantity of stock in one-half the time the rate of gross profits is thereby doubled, whereas the fixed charges or overhead has not increased.

As a prominent sales manager has aptly put it, the answer to the whole problem is: Assuming that your present volume carries sufficient profit to at least let you break even, then any thing you can do to take on business at even lower gross profit, which does not increase your expense, is velvet to the extent of the amount of the gross profit.

If a man invests $20,000.00 and earns 20 per cent gross on his capital on one turnover per year his gross sales would be $24,000.00 per year. If his turn over was on the basis of six months, with the same investment, he would do $48,000 business and the profit would be $8,000 or 40 per cent gross on the investment. If his turnover was on the basis of three months he would do $96,000 business, and the profit would be $6,000 or 80 per cent gross on the investment. If his turnover was on the basis of two months, he would do $144,000 of business, and the profit would be 120 per cent gross on the investment.

From the above it will be seen that it is an exceedingly desirable thing for the manager of a business to constantly watch the condition of his stock and to study the demands and requirements of his customers so that he will at all times be in a position to take care of these requirements, either out of his own stock or out of the stock of the manufacturers or jobbers available, and at the same time not penalize himself with a slow-moving stock which not only bears heavily upon the overhead, but also is subject to depreciation and style charges.

The Modern Need is "Everyday Arithmetic"

Mr. Stanley A. Dennis, writing in Electrical Merchandising, complains of the old fashioned methods of teaching arithmetic which are still extant in this year of modern times —1918. He points out that the type of problem a boy gets in school is about as much use to him when he enters business as his Greek and Latin. He also offers a few common-sense suggestions along the following lines:

Yes, sir! Just think of it! Your tangle-haired youngster playing with his blocks on the floor may know more about business arithmetic at fourteen than you did at twenty-five. As a business man, the chip of the old block has a good chance to outclass the old block himself. Why? Because the folks who write arithmetics are waking up at last. They have discovered that for years they forgot a most important subject. And that is—overhead, or the cost of doing business.

Remember how in your barefoot days you longed to streak it for the old swimming hole, but were forced to stick to your desk and "figger out" this sort of stuff?

If Mr. Martin Culbertson, a retail merchant of Hopkins Corners, buys a barrel of salt at $5 and sells it at $7.50, what was his profit? What was his rate of profit?

If Mr. Silas Whipple buys $10,000 worth of merchandise a year and sells it at 9 per cent. more than he paid for it, what was his profit?

Looks familiar doesn't it? But where do you see anything about overhead in this kind of a problem? And what other definition could a barelegged lad like you infer than that profit is what is left of the selling price after the purchase price of the article is deducted? Yet that is exactly the definition of profit on which many of your school-day playmates are trying to do business to-day, because overhead was the forgotten element in business when you were a slim shaver busy with sponge and slate pencil.

It is a safe bet that the arithmetic you plugged through never mentioned the cost of doing business, and that you started out with only three words in your bookkeeping vocabulary: purchase price, selling price, profit. Then one day you looked helplessly into an empty cash drawer and a new word dropped sizzling into your brain—expense! And as the years have gone by one expense after another has jolted you in turn until at last you've developed a somewhat disgruntled acquaintanceship with a lean and hungry fellow you call "Overhead," to whom you never tip your hat nor offer a cigar.

Well, your boy is luckier than you. He doesn't have to go through that process. Overhead is no longer forgotten, and in his battered "'rithmetic" overhead now has as large a place as the yardstick and the bushel basket. This means that what you have learned under hard knocks about charging in the cost of rent, light, heat, insurance, advertising, freight, and delivery and other items since you went into business for yourself, your boy will learn under gentle instruction from the pages of a down-to-the-minute business arithmetic. So when he opens his own electric shop for the first time some day in the sweet bye-and-bye, he will start his business career set four-square against all the financial hurricanes that may blow against him.

To W. Creighton Peet, chairman of the National Association of Electrical Contractors and Dealers, seems to belong the credit for first discovering an arithmetic which takes care of overhead. Mr. Peet first called the attention of contractor-dealers to this arithmetic in a speech at the recent national convention in Cleveland.

Here is the book: It is "Everyday Arithmetic," published by Houghton Mifflin Company. It is in three sections. Overhead is covered in "Book Three," intended for the seventh and eighth grades.

Here is what this new arithmetic (page 60) has to say about overhead, or expenses, as the book calls it:

A business man has many expenses to meet. A retail merchant, for example, must buy goods to sell; he must pay wages to his clerks and other employees, and he must meet expenses for rent, heat, light, insurance, advertising, freight, and the delivery of goods to his customer. Furthermore, he must see that the money invested in his business yields a fair amount of interest. To make his business profitable, therefore, a merchant must charge enough for his goods, not only to cover their cost, and to pay for the running expenses of his business, but also to leave a balance after all expenses have been paid.

How's that? Good, sound, business horse-sense, now isn't it? And read this problem:

After running a candy store for several months, a young woman found that it took 16⅔% of the amount she received for the candy to pay the clerk hire and other running expenses of the store. At that rate, what did she reckon as the cost of selling a box of candy for which she received 30 cents? For which she received 60 cents?

And this one:

The young woman wanted to find out what kind of candy brought her the highest per cent. of profit. On one grade of

The Goodwin Banquet is timed to start at 6.30 sharp. Don't be late and don't let anything—business or pleasure—keep you away.

chocolate, which she bought for 30 cents a pound she found that she was making a net profit of 10 cents a pound. This was what percent of the cost?

And this one too:

A dry goods merchant buys a suit for $15, and sells it for $25. After taking out the cost of the suit and 20 per cent. of the selling price to pay the running expenses of the store, the dealer makes a profit of how many dollars?

And another:

A merchants' sales for a year came to $42,486; his running expense to $10,206. The cost of his goods at wholesale was $27,052. His net profit was what per cent. of his sales? Of the cost of his goods at wholesale?

Good, are they not? Just for the fun of it, take out your pencil and "work" those four problems. It's good exercise, good practice for your own business.

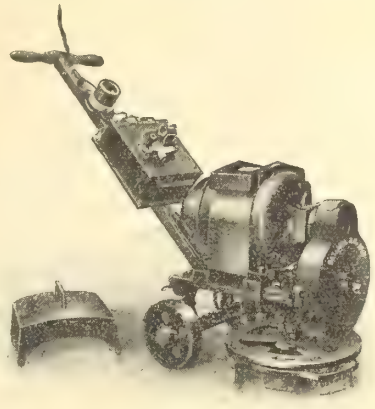
"It puts things in very clear and definite shape," says Mr. Peet, "and I know that if I had been educated with this arithmetic that it would have been much to my advantage. I think that you will readily agree with me that if all the children should have this one text put into their heads very clearly so that it will remain there, then business will be on a better footing than it is to-day."

Do you know **your** overhead? You can be sure that that boy of yours will know this. Electrical Merchandising has been telling you that if you want to make a 10 per cent. profit and if your overhead is 23 per cent. of your sales you must add 50 per cent. to your cost of labor and materials to get your selling price. But do you **know** your overhead is 23 per cent. or less? Maybe it is more. Can you prove it is less? Can you offer exact figures on some twenty-eight or more items of overhead that can be named? If not, it seems to me I hear your son explaining, about 1930:

"Poor dad. He went under just about the last year of the war. Seems he didn't know just how to handle his overhead. Can't understand it. Must have been something wrong with the arithmetic when dad was a boy."

Electric Floor Surfacing Machine

The Cavicchi Polishing Machinery Co. of Quincy, Mass., have developed a one-man type of motor operated floor surfacing machine for surfacing marble, terrazzo, granolithic, mosaic or any composition stone floors. It is very compact and powerful, and is said to give a perfect finish without



the necessity of hand labor after the machine. This is accomplished by a special flexible wheel; this wheel has individual members, which carry the abrasive; these are so arranged that they move independently of one another, thus following the lay of the floor and producing a uniform finish. The compactness of the machine makes it possible to use it in small rooms and it will finish flush to the wall. The machines are made in two sizes; the larger has a 2 h.p. electric motor, and the smaller a ¾ h.p. The 2 h.p. machine can, it is claimed, do the work of ten men.

The Inquiries Branch of the Department of Trade and Commerce, Ottawa, have received a request from a Sydney importer of electrical supplies for correspondence from Canadian manufacturers, together with catalogues and price lists. The reference number of the enquiry is 636.

Ten Ways to Kill an Association

1. Don't come to the meetings.
2. But if you do come late.
3. If the weather doesn't suit you, don't think of coming.
4. If you do not attend a meeting, find fault with the work of the officers and other members.
5. Never accept an office, as it is easier to criticise than to do things.
6. Nevertheless, get sore if you are not appointed on a committee, but if you are, do not attend the committee meetings.
7. If asked by the chairman to give your opinion regarding some important matter, tell him you have nothing to say. After the meeting tell everyone how things ought to be done.
8. Do nothing more than is absolutely necessary, but when other members roll up their sleeves and willingly, unselfishly use their ability to help matters along, howl that the association is run by a clique.
9. Hold back your dues as long as possible, or don't pay at all.
10. Don't bother about getting new members. "Let George (Kenneth A.) do it!"

Pittsburgh Window Reflectors

James Devonshire, Limited, 701 Yonge Street, Toronto, have been appointed sole distributors for Canada for the Pittsburgh Show Window Reflectors, designed for type C lamps. These are made in three styles—No. 100, shown in Fig. 1, No. 101; and No. 50, shown in Fig. 2. The reflector



Fig. 1

shown in Fig. 1 is suitable for the average window with a height of 8 to 10 feet with depth of one-half to two-thirds of the height, and where the trim extends well up the back wall. No. 101 is designed for the same class of window but gives a little more light at the front, illuminating the back wall at a somewhat lower intensity. No. 50, shown in Fig. 2, is made especially for high, shallow windows or for windows where light is to be cut off at the 50 degree line, such as where there



Fig. 2

is an upper background of glass or where the trim only extends part of the way up. It is also suitable for windows without background or for "island" windows, as the light source is concealed from the opposite side. All three of these reflectors are designed for 100 or 150 watt type C lamps. For larger lamp sizes different holders are supplied.

Preserve the fruits of prosperity through a policy of thrift. In the past Canada has been too much a nation of spenders. We should now become a nation of savers. If after this flow of posperity we experience acute depression, it will largely be our own fault. If we save we can weather any storm. What protection shall we have if we fail to save now? What excuse shall we have to offer? The door of opportunity is now thrown wide open to Canadians. Wealth has been showered upon us. Shall we let it all go? If we are thrifty we shall lay aside every surplus dollar. Let us save—for Victory—and for the rainy day that will almost surely follow.

Storage Batteries Ensure Continuous Service

The accompanying illustration shows a typical example of the Northern Electric Titan storage battery installation for working oil switches and emergency lighting in the West Portal sub-station of the Mount Royal Tunnel & Terminal Company, Montreal, at such times as the power might fail. The outfit consists of 64 cells of Titan Sealed in glass jars of a rated capacity of 135 ampere hours. The current requirement for switch operation is a maximum of 75 amperes for a period of from four to eight seconds. The cells, being sealed in, come fully charged and the connections, being bolted, render them easy to install in a minimum amount of time. Batteries of this type are furnished from



stock by this company and this particular set was in and working within a day of the receipt of the order.

The art of storage battery manufacture and merchandising may now be considered as having reached the state wherein the multitudinous demands may be met in the shortest possible time. For emergency work in operating switches, reserve lighting or various breakdown service, the storage battery has a place that careful operators do not overlook. They afford priceless insurance against serious accidents and delays. Interesting data on the application of storage batteries for all types of emergency service, marine lighting, automobile starting and lighting, farm lighting, fire alarm and signal service, telephone service, mine locomotive and all electrical vehicle service may be had by writing the company at Montreal or any of its branches.

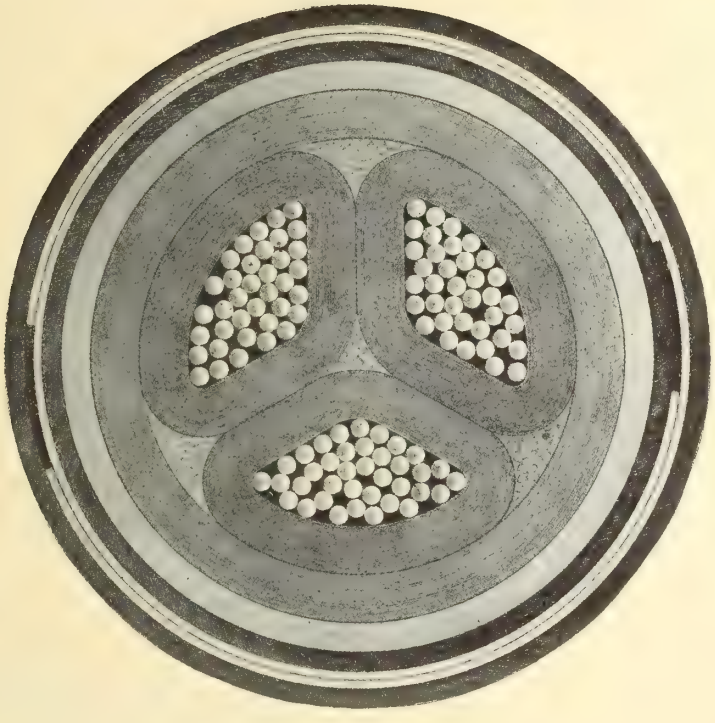
The new power transmission line to the Davidson property at Porcupine, Ont., in north-eastern Tisdale Township, is now almost completed.

The Ontario Gazette contains notice that, under the Ontario Companies' Act, letters patent have been issued incorporating "The Ontario Association of Electrical Contractors and Dealers."

The capital stock of the Western Electric Company, Limited, has been increased from $7,500,000 to $10,000,000.

The death occurred recently of Mr. George Black, 71 East Avenue South, Hamilton. Mr. Black, who was a pioneer telegrapher, was born in Montreal, eighty-one years ago, and as a young man entered the service of the G.N.W. Telegraph Company. He moved to Hamilton fifty years ago to manage the company's office in that city, having been previously stationed at St. Hyacinthe and Brockville. He had been manager at Hamilton until ten years ago.

POWER CABLE



350,000 C.M. 3-Conductor 12000 volt
Paper Insulated, Steel Tape Armoured Cable
Overall Diameter—3.62 ins.

Built to Specifications of Hydro-Electric Power Commission of Ontario

---

Eugene F. Phillips Electrical Works, Limited
MONTREAL

Branches: Toronto, Winnipeg, Regina, Calgary, Vancouver

Current News and Notes

Fort William, Ont.

It is stated that the city of Fort William, Ont., will endeavor to secure the consent of the railway board to a seven-cent fare in order to cover the present deficit.

Hamilton, Ont.

The Standard Underground Cable Company of Canada, Hamilton, Ont., have been given a contract for eight hundred thousands pounds of copper wire to be used in the extension of the transmission lines of the West Kootenay Power Company from Grand Forks to Princeton, B.C.

Guelph, Ont.

Continual power shortages and consequent tie-ups on the Guelph street railway have caused the management to issue "delay slips" which will be furnished the passenger upon application to the conductor. These are good for a trip at some other time or the money will be refunded at the railway office.

London, Ont.

On October 7 General Manager Warburton of the London and Lake Erie Railway Company announced that they would cease to operate very shortly and that the work of scrapping the road would commence immediately. A suggestion is now before the city to purchase eight miles of the road that runs between Lambeth and London and connect it with the London Street Railway.

New Westminster, B.C.

Messrs. Fred. J. Hume and C. P. Rumble, of New Westminster, B.C., have formed a partnership and opened a store at 55 Sixth Street to deal in electrical supplies, installations and repairs.

Renfrew, Ont.

A report of the Light Committee of Renfrew, submitted recently, contained a recommendation that the cheap heating rate of one-half cent per kw.h. on small disc heaters be discontinued. The town council, however, will continue the cheap rate on the ground that the 2-cent rate recommended would bar the use of the heaters and that as a measure of fuel economy they should be kept in service as long as there is sufficient water-power to generate current for their use.

Toronto, Ont.

Mayor Church has given notice of the following motion: "That the question of policy re the purchase of the Toronto Electric Light Company, in accordance with the notice of expropriation under the agreement with the city, be submitted to the ratepayers at the coming municipal election.

The Toronto Railway Company has asked permission to increase the fares to a straight 5 cents. The Board of Control, however, unanimously refused any concession. Thus, for the sake of two or three cents a day, every citizen of Toronto must put up with an inadequate service. The mayor and the members of the Board, of course, use their own cars and therefore can generously afford to let the electors suffer.

The earnings of the Toronto Street Railway Company for September, 1918, were $571,636 as compared with $532,007 for the same month in 1917.

Women Sub-Station Operators.

The Edison Electric Illuminating Company of Boston have been very successful in utilizing young women as sub-station operators. At the present time about thirty women are engaged in this work and there is every prospect that the number will be increased. Two sub-stations are being operated entirely by women and the service appears to be quite as reliable as when men were in charge.

The Energy Supply of North America

(Continued from page 24)

small due to their low heads and which cannot be economically developed by the synchronous generator due to the low head and corresponding low speed. The designing character of the induction generator, with regard to slow-speed machines are no better—if anything rather worse—than those of the synchronous generator, and the problem of the economical utilization of the low head water power still requires solution. It is not solved by the induction generator; the latter's characteristic is simplicity of the station, giving the possibility of numerous small automatic generating stations.

New York Subway Extension

(Continued from page 30)

city's growth along the new lines becomes more rapid, which in time results in congestion and demands additional facilities, which, in their turn, cause new growth, and so on around the circle indefinitely.

A large amount of new equipment was naturally needed for the Dual System and for this the Westinghouse Electric and Manufacturing Co. has furnished 600 control equipments and 978 Matroes for the Interborough lines, the total cost of this apparatus being over $3,000,000.

The power requirements are also greatly increased and to supplement its present power equipment, the Interborough Company has installed an 80,000 horse-power Westinghouse turbine generator, which is the largest in the world.

Further extensions are already being planned, notably a tunnel from Brooklyn to Staten Island—but that is in the future.



THE SWEEPERS OF THE SEA

Mr. Punch—"Risky work, isn't it?"

Trawler Skipper—"That's why there's a hundred thousand of us doing it!"

—Published through courtesy of "Punch."

GET THE GENUINE

Look for the Name

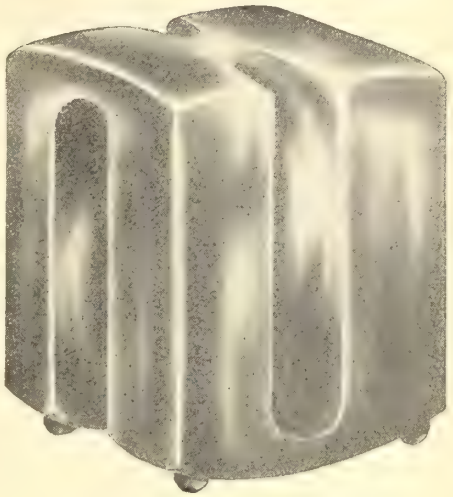
WHITE'S PORCELAIN STRAIN INSULATORS

You want strain insulators that are strong physically, that stand up under the exceptional conditions of the heavy storm; that hold up under a load of sleet; that don't crack when the thunder rolls, the lightning flashes, and the wind whistles.

This is the kind of strains T. C. White Company is making of porcelain in a variety of sizes for different loads, and several designs for varying conditions.

It will pay you to write for bulletin which shows designs and gives the complete data on strain and electrical tests.

Write today.



Type No. 600

T. C. White Electrical Supply Co., 1122 Pine Street, ST. LOUIS, Mo.

FERRANTI



Pole Type Transformers

Single and Three Phase

HIGH EFFICIENCY— LOW CORE and COPPER LOSSES

Write us for Prices and Delivery before ordering elsewhere.

House Service and Power Meters, Ammeters, Voltmeters, Current and Potential Transformers supplied from stock.

Ferranti Electrical Company of Canada, Limited

90 Sherbourne St. TORONTO | 704 Unity Bldg. MONTREAL | 592 Notre Dame WINNIPEG

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For Sale

[illegible] K.W. Westinghouse Generator, or Sub[illegible]
[illegible]s Meter, 3 phase, 60 cycle, 200 r.p.m.,
[illegible] cases, Ontario, 86,000

CHARLES LEACOCK,
1922 107 Duke St., Toronto

POSITIONS VACANT

Wanted Experienced man, returned soldier preferred, to act as Meter Reader and Inspector. Apply, stating experience, to Smiths Falls Hydro Electric System 12-t.f.

Electric Vehicles Not Barred on Sundays

In connection with the request of the Fuel Administration that gasoline cars be not run on Sundays, except in cases of necessity, our readers will find interesting the subjoined copy of correspondence reported in the Toledo Times, as having passed between the Milburn Wagon Company of Toledo and the Gasoline Department of the Fuel Administration at Washington:

"C. C. Winningham, Fuel Administrator, Gasoline Department, Washington, D.C.

What is the attitude of the fuel administration in regard to the use of electric automobiles on Sundays? This city has a great many electric automobiles and owners can see nothing in your request to restrict their use. Their use in no way helps in the gasoline conservation, and owners can see no patriotic reason why they should not be used. Electric car owners conserve gasoline 100 per cent on week days as well as Sundays.

Milburn Wagon Company."

Immediately upon receipt of this telegram at Washington the following telegram was returned:

"Milburn Wagon Company, Toledo, O.:

No objection to operation of electric cars on Sundays. Request applies only to gasoline and kerosene propelled automobiles.

Fuel Administrator Winningham."

Rate Increases.

The July Supplement to the Rate Book is the largest supplement thus far issued. Needless to say, in the case of nearly all the changes reported, the rates are increased, and the more general recognition of the necessity for increasing rates for all classes of lightning service, as well as for power, is reflected in the new schedules reported. Many of the increases shown are effected by means of a surcharge, expressed in percentage of the net bills, while many others are effected by a specified increase in the rate per kilowatt-hour consumed.

Two decisions by the California Railroad Commission, granting increases as noted to two companies in that state are of much interest as showing the recognized merit of such claims for increased rates as central station companies are obliged to make at this time. It is expected that the 1919 edition of the Rate Book, which will contain all revisions of rates up to January 1st, will be ready for distribution by the latter part of December.—N. E. L. A. Bulletin.

PETRIE'S LIST

of New and Used

MOTORS

FOR IMMEDIATE DELIVERY

No.	H.P.	Phase	Cycle	Volts	Speed	Maker
1	100	3	25	550	480	Westg.
1	40	3	25	550	750	C. G. E.
1	30	2	60	220	1500	T. & H.
1	25	2	60	220	945	Westg.
1	25	3	60	2000	900	C. G. E.
1	20	3	25	550	1440	J. & M.
1	10	3	25	550	720	Westg.
1	7½	3	25	550	750	C. G. E.
1	6	2	60	220	1200	T. & H.
3	5	3	25	550	720	Westg.
5	4	3	25	550	1400	Excelsior
2	3	3	25	550	1500	C. G. E.
3	3	3	25	550	1400	Excelsior
1	1	3	25	550	1400	Excelsior
1	¼	3	25	550	1500	T. & H.

Write Us for Prices

H. W. PETRIE, Limited

Front St. West - Toronto, Ont.



Rubber Covered Wires and Cables

FOR POWER, LIGHT AND TELEPHONE WORK

Incandescent Lamp Cord, Flexible Switchboard Cables, Special Cords and Cables for all kinds of Electrical Work.

Prompt Shipments from Canadian Factory.

BOSTON INSULATED WIRE & CABLE CO., Limited

Canadian Office and Factory, HAMILTON, ONT.

DIRECT READING OHMMETERS



Thompson-Levering Co., Philadelphia, Pa., U.S.A.

Tenders

A few dollars spent in advertising your proposals in

The Contract Record

would result in additional competition, which might save your city or town or your client many hundreds of dollars.

POWER EQUIPMENT

Immediate Delivery

TRANSFORMERS

25-CYCLE, S.P.

No.	K.V.A.	Volts.
5	300	2200-550
3	50	2200-550
3	40	2200-550
6	7½	2200-550
2	15	2200-110-220
1	7½	2200-110-220
3	5	2200-110-220
3	100	13200-6600-2200
3	150	13200-2200

60-CYCLE, S.P.

No.	K.V.A.	Volts
2	50	2200-110-220
2	40	2200-110-220
4	15	2200-110-220
6	10	2200-110-220
4	5	2200-110-220

MOTORS

25-CYCLE, 3-PHASE

No.	H.P.	Volts	R.P.M.
1	150	2200	500
1	100	2200	710
1	200	550	500
1	100	550	710
1	50	550	720
1	40	550	720
1	30	550	720
1	25	550	720
1	20	550	720
1	15	550	720
1	10	550	720
2	5	550	1500

60-CYCLE, 3-PHASE

Write for Full Lists.

GENERATORS

25-CYCLE, 3-PHASE

No.	K.V.A.	Volts	R.P.M.
2	450	550	125

D.C. TO ENGINE.

60-CYCLE, 3-PHASE

No.	K.V.A.	Volts	R.P.M.
1	600	2200	225
1	300	2200	150
1	75	2200	900
1	50	550	1200
1	125	220	900
1	75	220	900

Direct Current Machines in 125 and 220 V., 5 to 200 K.W.

FOR PRICES AND COMPLETE LISTS WRITE OR WIRE

E. A. LOWRY

GUELPH *POWER EQUIPMENT* **CANADA**

Selections from Our Stock of Motors
3 Phase, 60 and 25 Cycles

3 PHASE, 60 CYCLE MOTORS

Qu.	H.P.	Make	Volts	Type	Speed
1	¼	R&M NEW.	110		1700
1	½	G.E. NEW..	110	KT	1800
1	½	G.E.	110	I	1800
1	1	G.E.	220	KT	1800
1	1½	Wstgh. . . .	220	CSA	1725
1	3	Cr. Wh. . . .	220		1720
5	5	G.E. NEW. no starter slip ring	220	MT	1800
4	5	Cr. Wh. . . .	220	Q	1720
1	5	C. Wh. . . .	550	Q	1720
3	5	Wstgh. NEW	220	CS	1130
1	5	Wstgh	220	CCL	1700
4	5	Wstgh. NEW	220	CS	1735
10	5	G.E.	440	KT	1200
53	7	G.E.—motors only	550		1200
		(New Fbks. M. resistance starters starters for above)			
1	7½-15	Cr. Wh..	220		865/1735
1	7½	G.E. NEW..	220	KT	900
1	10	G.E.	220	L	1200
2	10	G.E. NEW..	220	KT	1200
5	10	G.E. NEW.. slip ring—no starter .	220	MT	1800
1	10	R&M	220	K	1750
2	7½	G.E. NEW..	220	KT	1800
6	7½	G.E., motors only	550	KT	1800
		(New Fairbanks-Morse resistance for above)			
1	10	Wstgh. . . .	220	CCL	1700
1	10	Wstgh. . . .	220	CS	1150
2	10	Wstgh. NEW	220	CS	1150
1	10	Burke	220		1200
1	10	Cr. Wh. with resistance type starter.	550	Q	1800
2	15	G.E. NEW..	220	KT	900
9	15	Wstgh. NEW	220	CS	1155
1	15	G.E.	220	I	900
1	15	Wstgh. . . .	220		1165
1	15	Wstgh. NEW	220	CS	860
1	20	Wstgh. NEW	220	CS	860
2	20	Wstgh. . . .	220	CS	1160
1	20	G.E.—Special feet no starter . .	220	M	900
42	80	Fbks. M.	220/440	KBV	1200
1	20	G.E. slip ring, intermittent duty no controller .	220	IM	900
		Controller with grids for above			
3	25	Wstgh. NEW	220	CS	865
9	25	Wagner .	220/440	BP	1120
2	30	Wagner New	220		850
1	35	Triumph.	220/440		900
1	40	Fbks. M. .	220		900
1	50	Triumph . .	220		720
1	50	Allis-Chal. . .	220		1750
1	50	Wstgh. NEW	440	CS	860
1	75	Wstgh. NEW	440	CS	720
1	100	Allis-Chal. . .	550		690
1	100	G.E.	550	K	600
1	100	G.E. NEW .	550	M	600
1	150	G.E. NEW .	220	M	580

3 PHASE, 25 CYCLE MOTORS

Qu.	H.P.	Make	Volts	Type	speed
5	5	G.E.	220	KT	1500
1	5	Wstgh. . . .	220	CCL	1420
2	5	Wstgh. . . .	220	CCL	705
15	15	Allis-Ch. . .	220		750
2	25	G.E.	440	I	750
1	40	Wstgh. . .	220	MW	695
1	50	Allis-Ch. intermittent duty, sl. rg. drum controller	440		500
1	55	Wstgh.sl.rg. 30 cycles, complete. .	440		860
1—60/45/30 G.E.			440		500-375/250

GEORGE SACHSENMAIER CO.

Office and Salesrooms: 141-43-45 N. Third Street.
Warehouses: 928-30-32 N. Third Street, **PHILADELPHIA**

List of Motors
SECOND HAND

No.	H.P.	Phase	Speed	Volts	Cycles	Starter	Make
1	50	3	750	550	25	yes	C.G.E.
1	60	3	750	550	25	yes	Crocker Wheeler
2	50	3	750	220	25	yes	Lincoln
1	25	3	750	220	25	yes	Lincoln
1	25	3	750	220	25	yes	C. G. E.
1	15	3	1500	220	25	yes	T.H.E.
1	10	3	1500	220	25	yes	T.H.E.
2	5	3	750	550	25		Westgh. CCL.
2	½	1	1500	110/220	25		Century & Wagner
1	½	1	1800	110	60		Fort Wayne
1	¾	1	1800	110	60		Westgh.
1	¾	1	1800	110	60		Fisher
1	40	2	900	220	60	yes	Fuller Wenstrom
1	15	2	1200	220	60	yes	C.G.E.
1	10	2	variable	220	60	no	Westgh.
2	10	2	1200	220	60	yes	Westgh. CCL.
1	10	2	1800	220	60		T.H.E.
1	7½	2	1200	220	60	yes	Crocker Wheeler
2	5	2 or 3	1800		60		Westg. CCL. rewd.
2	5	2	1200	220	60	no	Westg. C.
3	5	2	1800	220	60	no	Westg. CCL.
2	1	2 or 3	1800		60	no	Westg. CCL. rewd.
1	¾	2	1800	220	60	no	Westgh. CCL.
2	10	2 or 3	1200		60	no	Westg. CCL. rewd.
1	3	3	1200	220	60	no	Westg. CCL.
2	3	3	1800	220	60	no	C.G.E. rewound
1	20	3	900	220	60	yes	Lincoln
4	7½	3	1800	220	60	yes	Lincoln.

TRANSFORMERS

1 40 K.W. Type R60 2200-220 volts, Packard
2 75 K.W. Type H.G.60 1040/2080-115 230 volts C.G.E.
1 10 K.W. Type C 2200-220 volts, Westgh.

Toronto & Hamilton Electric Co.

99-103 McNab St. N., HAMILTON Limited

Standard Package Assortments

—OF—

Decorated and Etched

Illuminating Glassware

Illustrated in Catalogue No. 6

Selected from the best sellers in the line



In order to make it easy for our customers to *carry in stock* our Color Decorated and Etched Shades we have made up Standard Package Assortments of 6 dozen Shades—12 different designs—6 pieces of each



Also Standard cases containing 6 Decorated or Etched Bowls each one different

Full particulars on application *Order now for Fall delivery*

Made in Canada by

Jefferson Glass Co., Limited

Factory and Head Office: 388 Carlaw Ave., Down Town Show Rooms: 164 Bay Street TORONTO

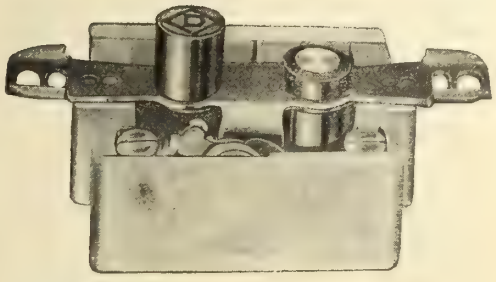
MONTREAL
285 Beaver Hall Hill

WINNIPEG
Scott Block

VANCOUVER
325 Howe Street

Approved Flush Switch

Shallow Type



Single Pole No. 200—Three Way No. 203

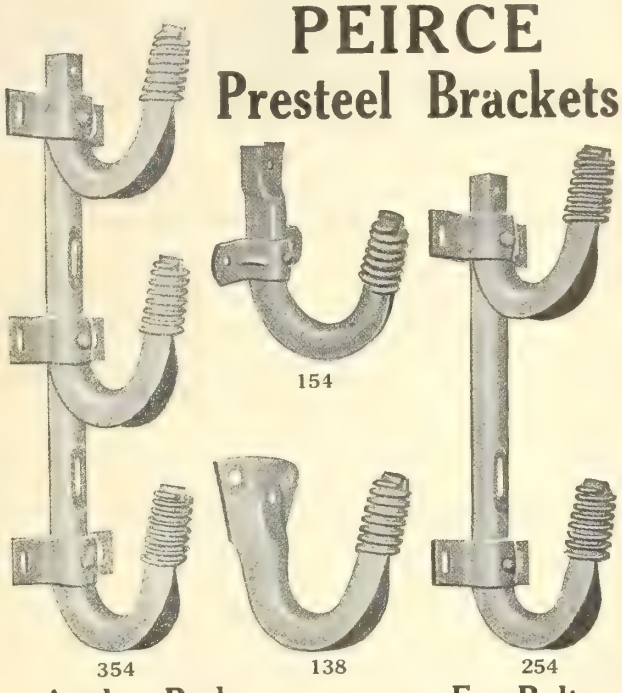
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Manufacturers

The Duncan Electrical Company, Limited

1665 St. James St. - MONTREAL, QUE.

PEIRCE
Presteel Brackets



354 154 138 254

Anchor Rods Eye Bolts
Cross Arm Braces
Turn Buckles Machine Bolts
all Hot Galvanized

Acme Stamping & Tool Works Ltd.
Hamilton, Ont.

Friends of the Electrician

"ANTI-SULPHURIC" ENAMEL
The only reliable protection against the action of acid and chemical fumes.

"FERRODOR"
Rustproof elastic paint. Superior to Graphite or Red Lead. Defies all climatic conditions.

"DRIOROL"
Oil-proof Enamel. Dries quickly over greasy and oily surfaces. Not affected by lubricating or transformer oils.

"ARMOUR"
Fire-resisting paint, or colorless solution.

"ARMACELL"
Possesses the highest insulating qualities of any varnish on the market.

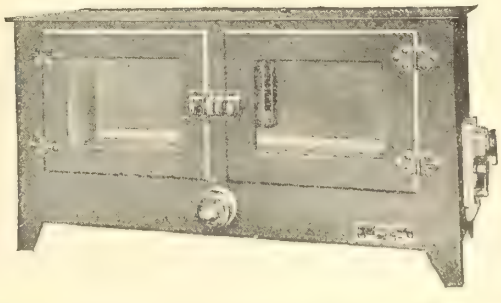
"OHMALINE"
Black, quick air-drying insulating composition. Also supplied for stoving, and as a solid insulating compound.

"SHAYDOLITE"
for coloring electric lamps. Used in the Royal Navy. Weatherproof. Dries rapidly.

"ARMABRON"
Bitumen protective paint, elastic, acid-resisting, weatherproof.

Made in London, England, by
GRIFFITHS BROS. & COMPANY
(Contractors to H. M. Imperial and Overseas Governments)
STOCKED BY
SPIELMAN AGENCIES, (Regd.)
Dealers in Electrical Specialties
Read Bldg., St. Alexander St. MONTREAL

Electric Ovens



Despatch Electric Ovens
for
Flour and Cereal Millers
Enamelling, Pulp Mills
and all commercial work requiring accurate and regulated electric heat.

Enquire about them.

The Masco Company, Ltd.
91-93 Queen St. E. TORONTO
JOBBERS OF STANDARD ELECTRICAL SUPPLIES

LINCOLN MOTORS

Lincoln Arc Welders

SAVE 50%

You can save 50% — very often more—by doing your boiler plate work with a Lincoln Arc Welder instead of rivetting it.

Lincoln-welded joints are 100% strong — rivetted joints are no stronger than the rivets themselves.

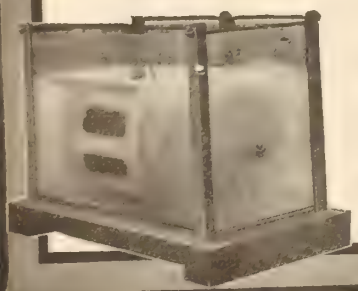
The Lincoln Arc Welder avoids awkward overlapping on corners, thus saving time.

Its heat is greater, more concentrated, and more readily controlled than that of any gas or other welding system, and the current is all usefully employed—there are no "ballast resistances" to waste 50% to 80% of the power taken.

It has been adopted by boiler shops, structural steel works, street car and railroad companies as being the most practical solution of the present labor shortage.

Lincoln Electric Co.

of Canada, Limited



Head Office
1109 Temple Building
TORONTO
Ontario

Factory
CLEVELAND
Ohio

DEVOE Specialties

Service Boxes
Formed Steel Boxes
Cast Iron Boxes
Panel Boxes
Special Boxes

Knife Switches
Field Discharge Switches
Motor Starting Switches
Motor Control Switches
Disconnecting Switches
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Lighting Panels
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Lugs

Bus Bar Clamps

Wire Connectors

Ammeter Plugs
Voltmeter Plugs

Porcelain Bushings

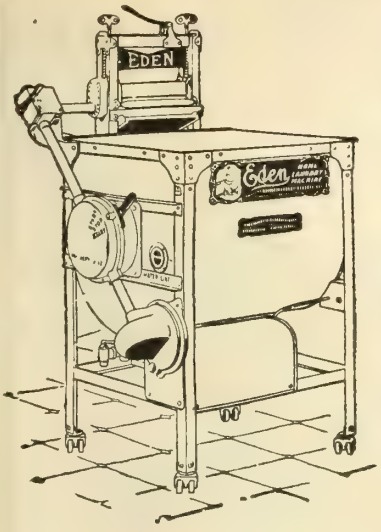
Ground Clamps

Marble and Slate

Send us specifications and we will quote you price.
Write for our new Bulletins.

The Devoe Electric Switch Company

414 Notre Dame St. West
MONTREAL



The EDEN Electric Washer

Good Profits—Easy Sales

are assured for the dealer who handles the Eden Washing Machine. A first grade machine, that once sold, stays sold and brings new customers.

Write for our proposition

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"The workmen have formed the habit of using Dossert Connectors for all kinds of connections and consider it a hardship if they are called upon to perform the tedious and laborious task of making a soldered joint with its attendant acid fumes, gasoline torch smoke and burned fingers."

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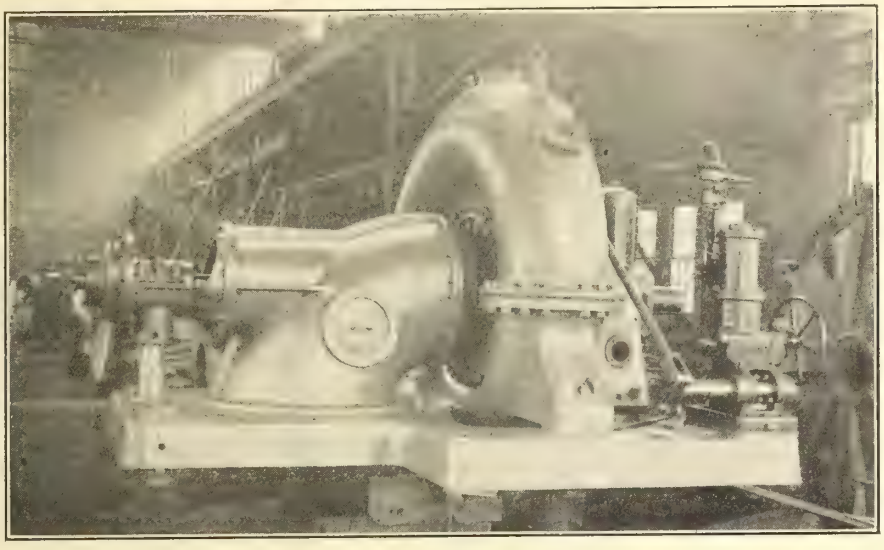
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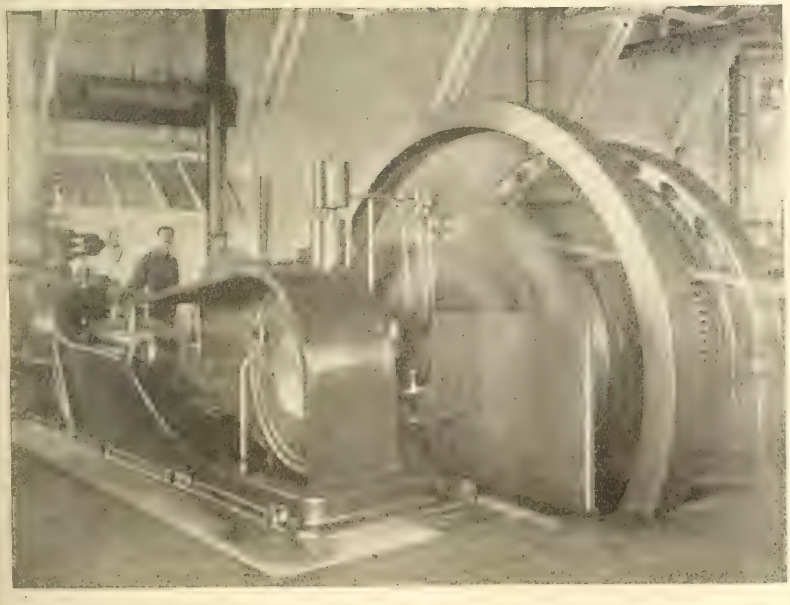
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Continuous Service

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25 Cycle Engine Generator Sets For Sale



These units were in use only—300 K.W. three months, and 250 K.W. seven months, and are in first class condition.

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25 Cycle, 3 Phase, Westinghouse Generators, Direct Connected to McIntosh & Seymour Cross Compound Gridiron Valve Engines, 150 R.P.M.

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Write for further particulars and quotations

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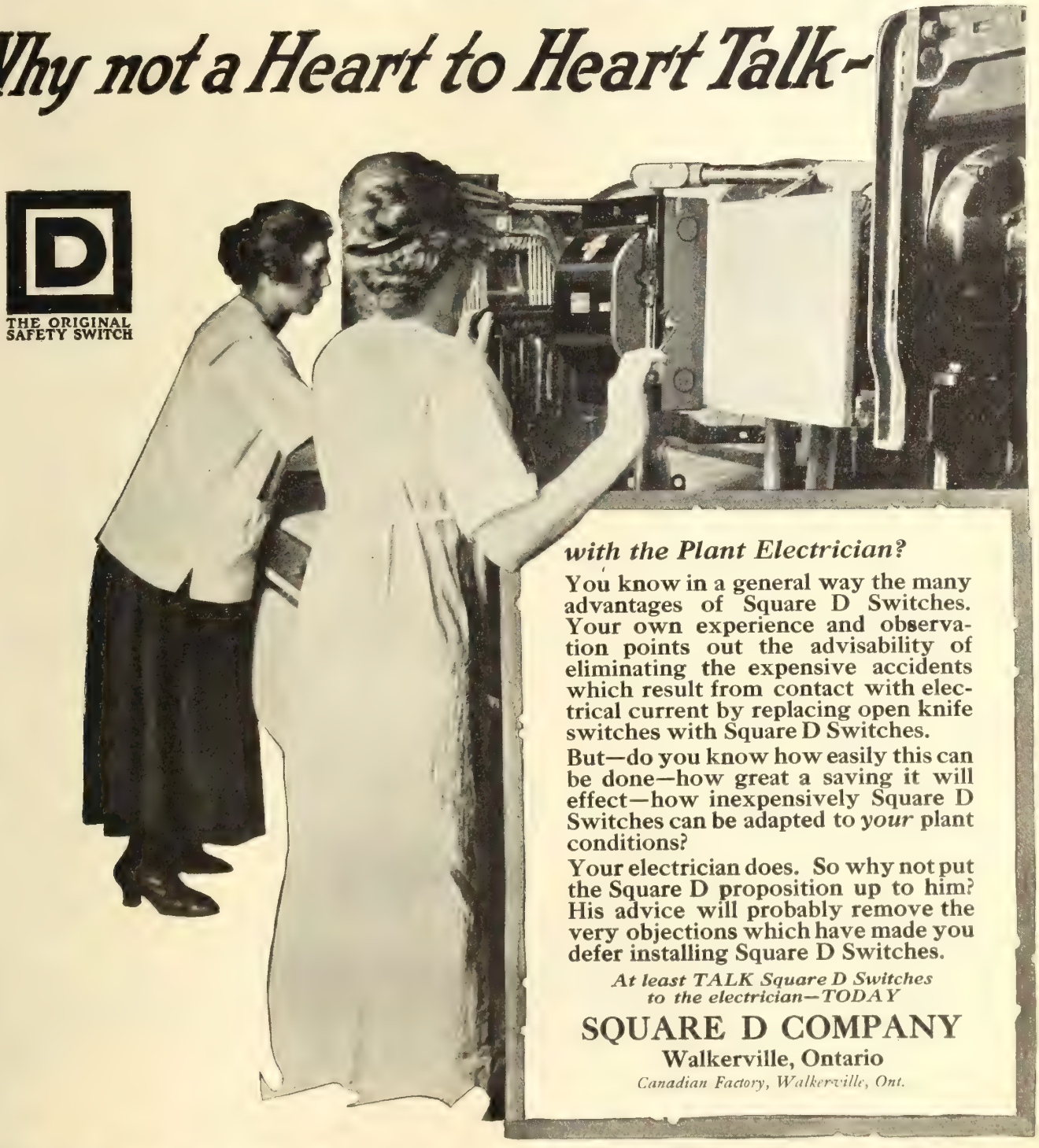
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(Continued on Page 50)

SQUARE D

SWITCHES

Why not a Heart to Heart Talk-



THE ORIGINAL SAFETY SWITCH

with the Plant Electrician?

You know in a general way the many advantages of Square D Switches. Your own experience and observation points out the advisability of eliminating the expensive accidents which result from contact with electrical current by replacing open knife switches with Square D Switches.

But—do you know how easily this can be done—how great a saving it will effect—how inexpensively Square D Switches can be adapted to *your* plant conditions?

Your electrician does. So why not put the Square D proposition up to him? His advice will probably remove the very objections which have made you defer installing Square D Switches.

At least TALK Square D Switches to the electrician—TODAY

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Walkerville, Ontario

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do not hinder production

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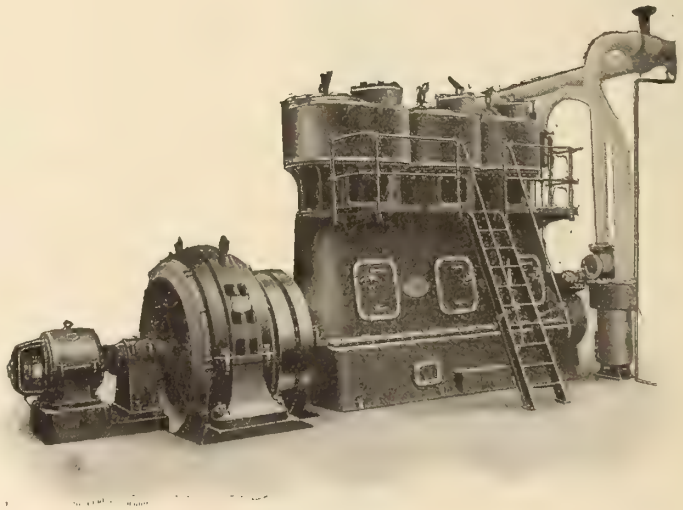
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The "Lancashire" Ball Bearing Induction Motor and "Patent Reversing Drive for Metal Planers," will repay investigation.

Descriptive matter sent on request.



750 K.V.A. Alternator direct coupled to engine.

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Montreal

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Head Office and Works, TORONTO

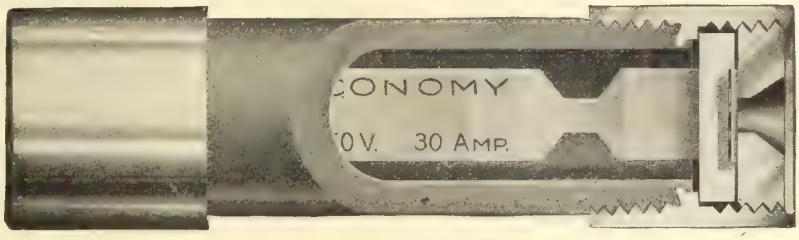
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Day after day, week after week, month after month, for the five years that Economy Fuses have been on the market, the sales have maintained a constant growth—not alone in volume, but also in percentage of increase. This is because

ECONOMY Renewable FUSES

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UNITY BUILDING - MONTREAL
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NON-ACID—FOR SODERING

25 years ago Mr. Allen produced the only non-acid sodering flux ever placed on the market.

Since then Allen fluxes have maintained an easy lead over all competition, being the only Flux approved by the National Board of Fire Underwriters and the preference of America's leading electrical and industrial corporations. Samples Free.

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126 Lombard - Winnipeg, Man., Canada.

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Manufacturers of Aluminum

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will solder aluminum to itself or other metals

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The following Books are Offered Subject to Previous Sale:

A Handbook on the Steam Engine, by Herman Haeder. Published in 1914 by Crosby, Lockwood & Son. 522 pages, illustrated. Price $3.00.

A Laboratory Manual of Alternating Currents, by John H. Morecroft, E.C. Published in 1912 by Renouf Publishing Company. 248 pages, illustrated. Price $2.00.

Alternating Currents—Examples for Students and Engineers, by Prof. F. E. Austin. Second edition, Vol. I. Published in 1916. 223 pages, illustrated. Price $2.40.

Baudot Printing Telegraph System, by H. W. Pendry. Published in 1913 by Whittaker & Company. 144 pages, illustrated. Price $1.00.

"Central Stations," by Terrell Croft, 1st edition published in 1917, by McGraw-Hill Book Co., Ins. 332 pages, illustrated. Price $2.50.

Direct-Acting Steam Pumps, by Frank F. Nickel. Published in 1915 by McGraw-Hill Book Company. 258 pages, illustrated. Price $3.00.

Direct Current Machinery, Theory and Operation of, by Cyril M. Jansky, B.S., B.A., 1st edition, just published by McGraw-Hill Co., Inc. 285 pages, illustrated. Price $2.50.

Dynamo-Electric Machinery, by Francis B. Crocker, E. M., Ph.D. Published in 1908 by American School of Correspondence. 236 pages, illustrated. Price $1.00.

Electric Arcs, by Clement D. Child, Ph.D. Published in 1913 by D. Van Nostrand Company. 194 pages, illustrated. Price $2.00.

Electric Car Maintenance, by Walter Jackson. Published in 1914 by McGraw-Hill Book Company. 274 pages, illustrated. Price $2.00.

Electric Cooking, Heating and Cleaning, by Maud Lancaster. Published in 1914 by D. Van Nostrand Company. 330 pages, illustrated. Price $1.50.

Electrical Machinery—Principles, Operation and Management, by Terrell Croft. Just published by the McGraw-Hill Book Co. 318 pages, illustrated. Price $2.00.

Electrical Meters, by Cyril M. Jansky, B.S., B.A. Second Edition, just published by McGraw-Hill Book Company. 416 pages, illustrated. Price $3.00.

Electric Railway, by A. Morris Buck, M. E. Published in 1915 by McGraw-Hill Book Company, Inc. 390 pages, illustrated. Price $3.00.

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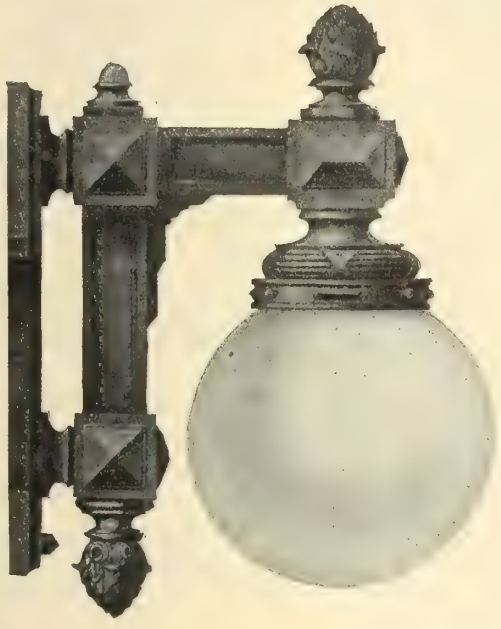
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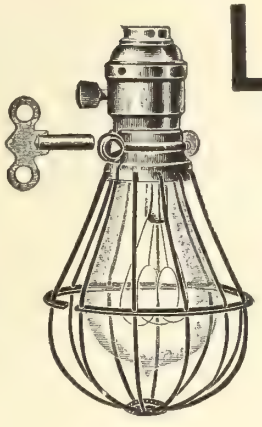


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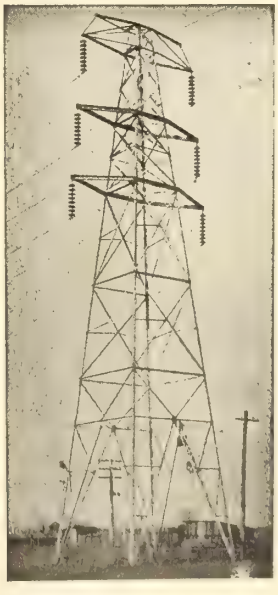
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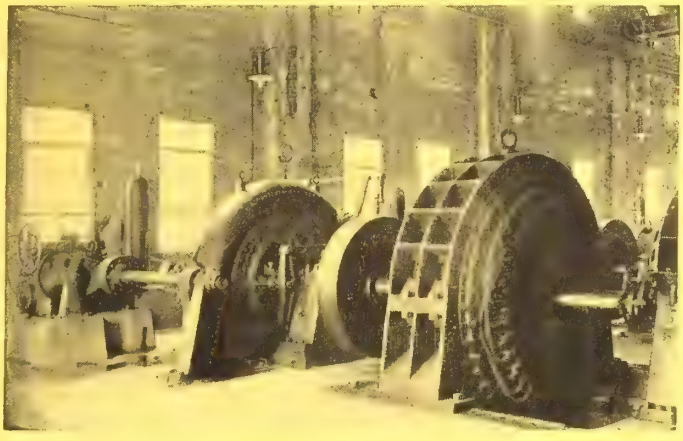
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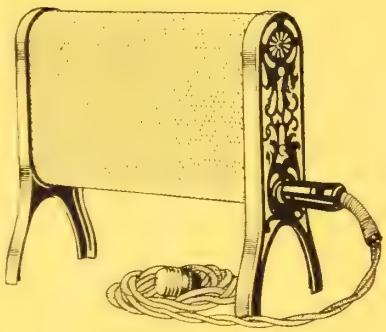
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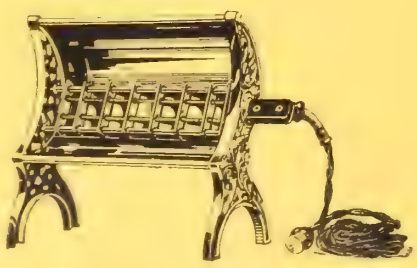
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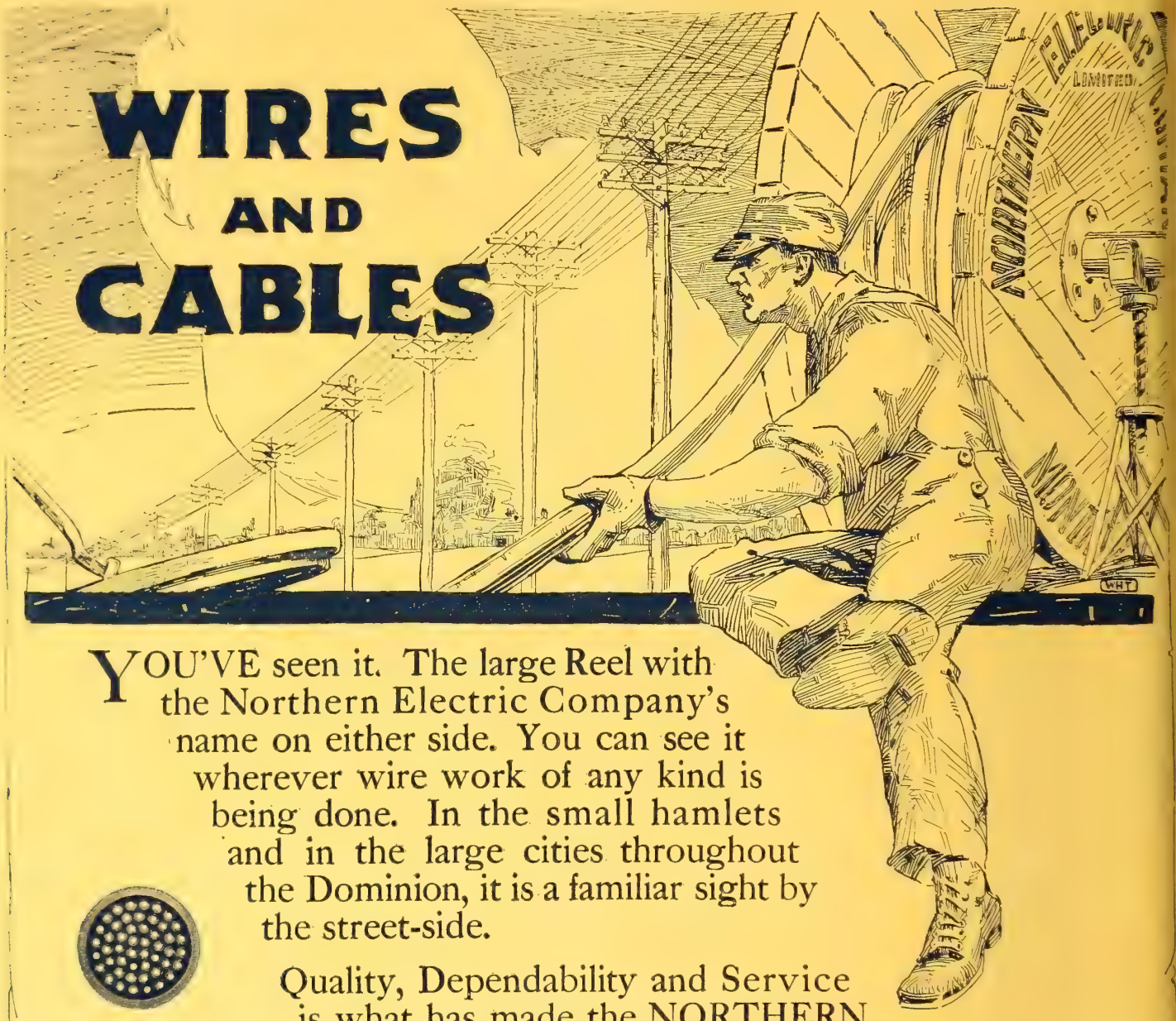


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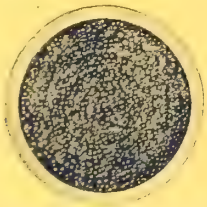
Report of the Goodwin Banquet in this issue

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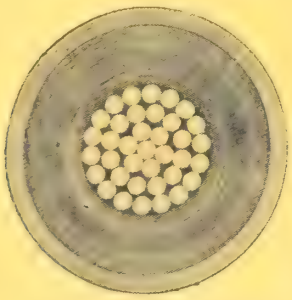


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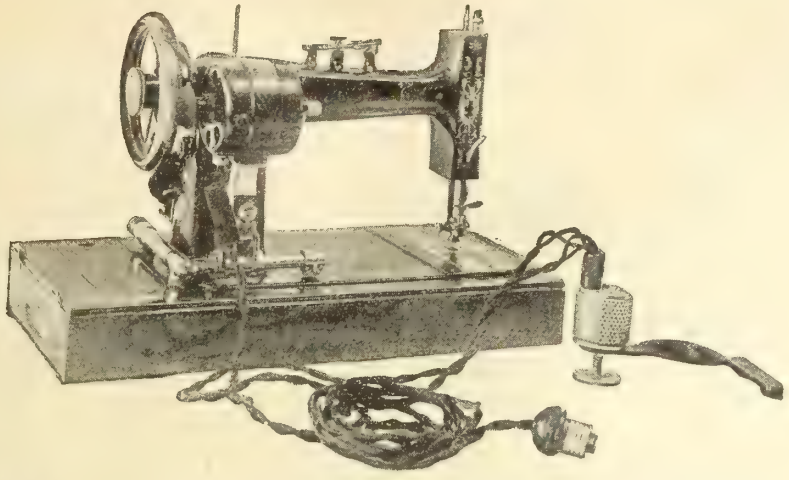
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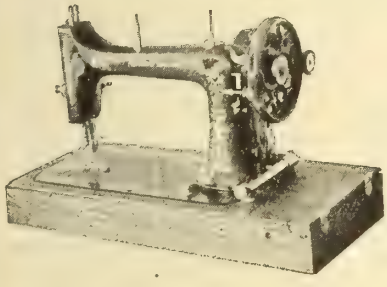
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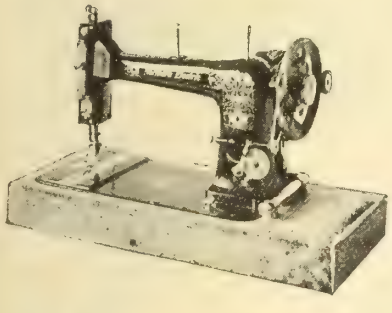
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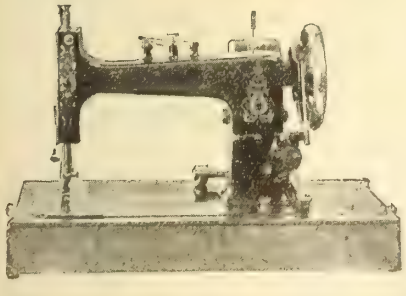


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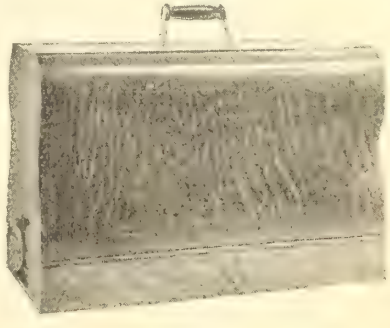
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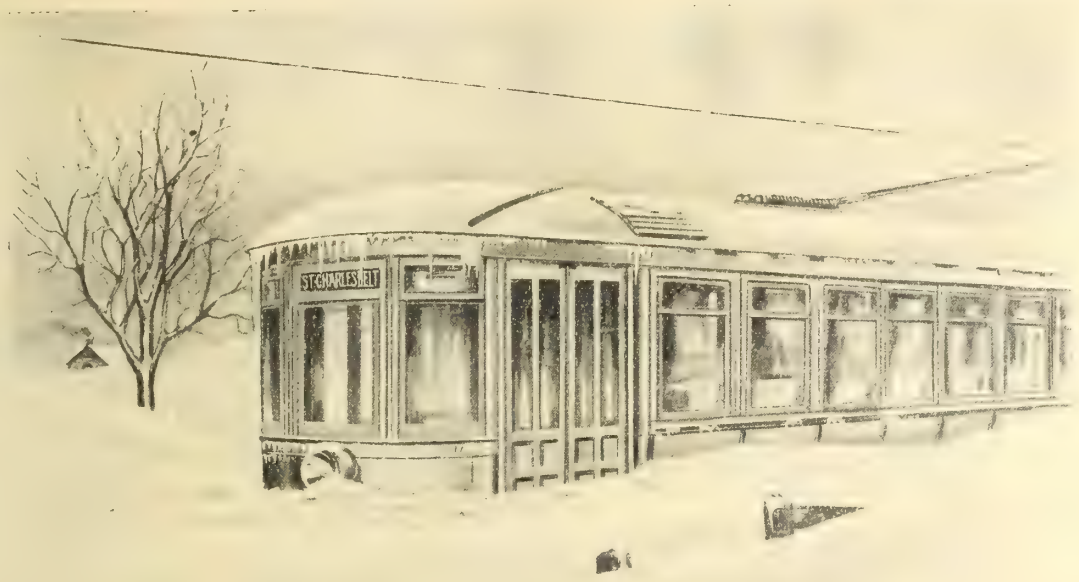
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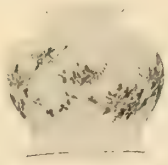


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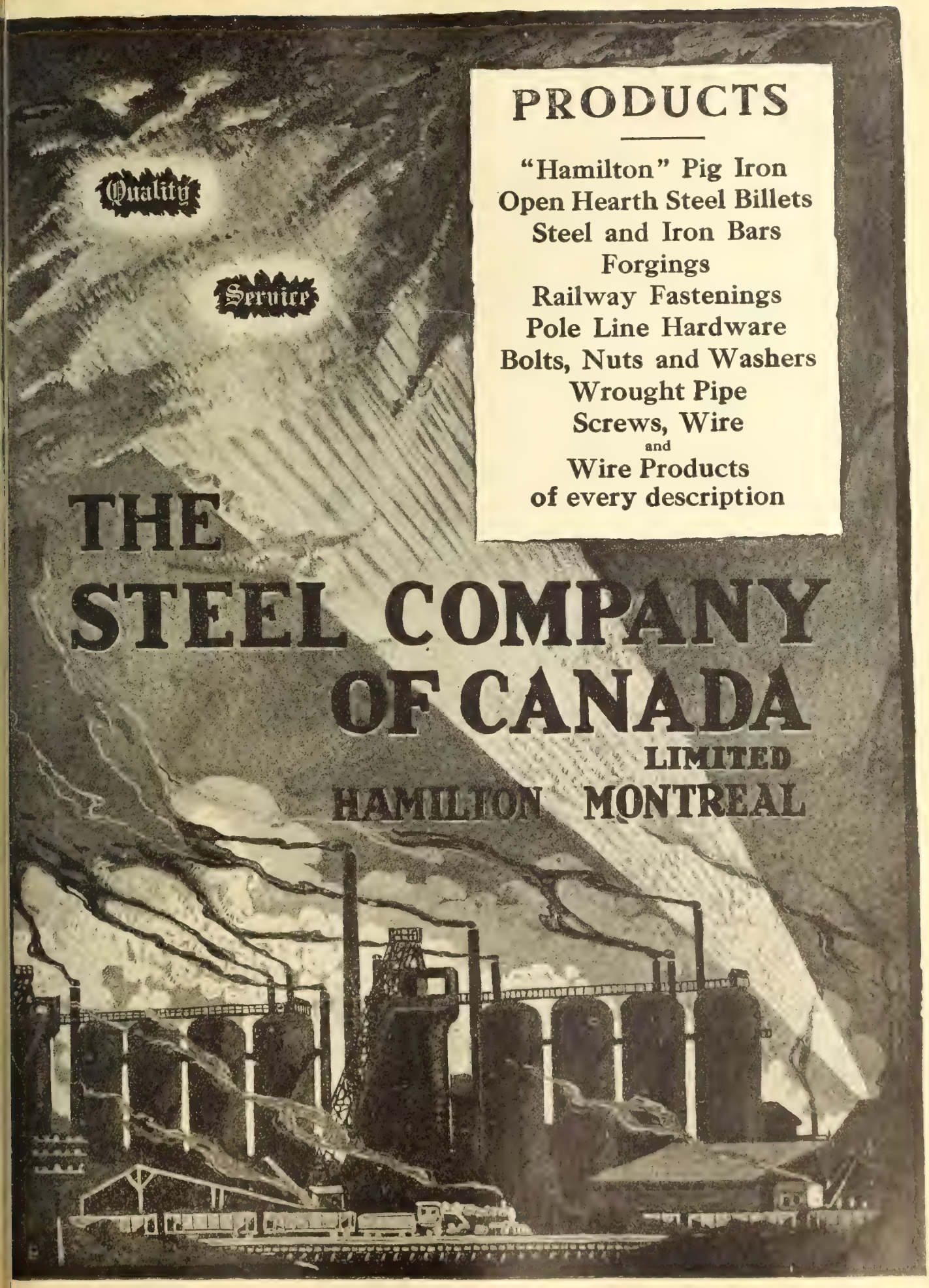
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Toronto and Hamilton Electric Co. 4
Tubular Woven Fabric Company .

Wagner Electric Manufacturing Co. 4
Ward Leonard Electric Company .
White Electrical Company, T. C. .

THE "TYPE S" PORTABLE WHEATSTONE BRIDGE



Useful in the Shop and Laboratory for the Measurement of Resistance. Adapted for Fault Locations in Telegraph and Telephone Lines and Cables.

The Type S Bridge is a thoroughly practical instrument for shop and field use. Being complete in every detail it is ready at all times for immediate use. It is easily portable, its weight being but 8 pounds. The precision of adjustment of its coils (Rheostat 1/10 per cent., Ratio 1/20 per cent.) insures accurate measurements. The galvanometer, the weakest element of such an instrument, is unusually rugged. It is a separate element and may be removed for examination or repair by taking out two screws. The battery is of the ordinary "flash light" type, and renewals may be procured practically everywhere. The price is $66.25 net, f.o.b. Philadelphia, boxed for shipment.

Bulletin No. 530 describes this instrument.

THE LEEDS & NORTHRUP CO.

Electrical Measuring Instruments

4912 Stenton Ave. PHILADELPHIA, PA.



A "GALVADUCT' Building

"GALVADUCT"

"GALVADUCT"

The most perfect interior construction conduit on the market.

Recognized as the standard of high quality.

Always specify Galvaduct or Loricated CONDUITS

"LORICATED"

A high-class interior construction conduit of the enamelled type, proof against acid or other corrosive agents.

If your jobber cannot supply you—write us.

CONDUITS COMPANY

LIMITED

TORONTO

LORICATED

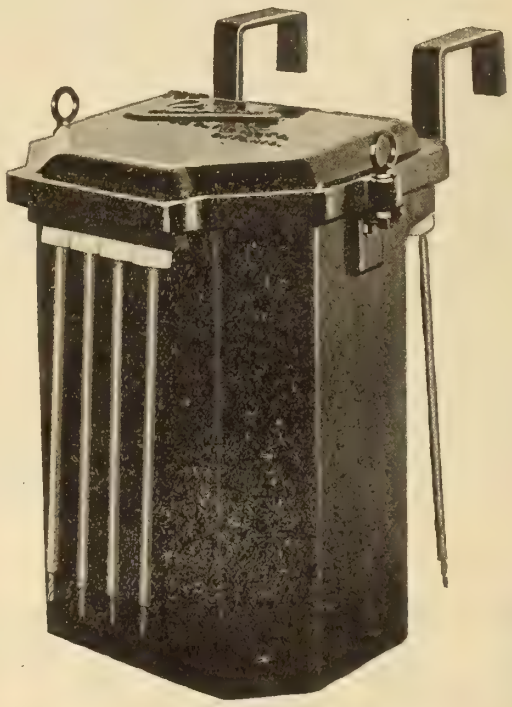
Packard SERVICE TRANSFORMERS

Coils Impregnated by Vacuum Process

Perfect Insulation

Mica Barriers

Strong Rugged Durable



Steel Cases

Light in Weight

Easy to Handle

Will Not Leak

Unsurpassed Appearance

Operating Characteristics The Best

WELDED STEEL CASES

We Build Large Power Transformers
Special Furnace Transformers
Current and Potential Transformers

THE PACKARD ELECTRIC CO., Ltd.

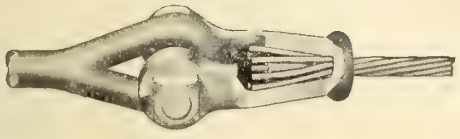
ST. CATHARINES, ONT.

Bank of Hamilton Bldg. Toronto

Power Building Montreal

Confederation Life Bldg. Winnipeg

MARCHAND CLAMPS FOR STRANDED WIRES AND CABLES



Marchand Clamps are the safest and most efficient Wire Clamps on the market.

Marchand Clamps are easily and quickly installed and save labor and material.

Marchand Clamps securely grip each wire of strand, eliminating strains which tend to weaken the strand.

Marchand Clamps cannot wear out or break and have been thoroughly tested and will not rust.

WRITE FOR COMPLETE CATALOG No. 33

STEEL CITY ELECTRIC COMPANY
"The Quality Line"
PITTSBURGH, - - PENN., U. S. A.

"KILLARK" ENCLOSED FUSES 600 VOLT

NATIONAL ELECTRICAL CODE STANDARD
TO 400 AMPERES, INCLUSIVE



"APPROVED."

Our 600 Volt Line of Fuses are acurately made, properly cartoned and Boxed.

We Make Good Deliveries.

KILLARK ELECTRIC MFG. COMPANY
ST. LOUIS, Mo., U.S.A.

Canadian Sales Agents

HATHEWAY & KNOTT, Inc.

Electrical Merchandise **120 Liberty Street, NEW YORK**

New York Headquarters for the Canadian Electrical Trade

Note That—The Cheapest STORAGE BATTERIES

are those made by the Canadian Hart Accumulator Company at St. Johns, Quebec.

Save at least 35 per cent. customs duties on Storage Batteries for every purpose. For lighting Farms, Towns, Country Houses, or for Electric Trucks,

May We Quote ? Our Prices to You

CANADIAN HART ACCUMULATOR

CO., LIMITED **ST. JOHNS, QUE.**

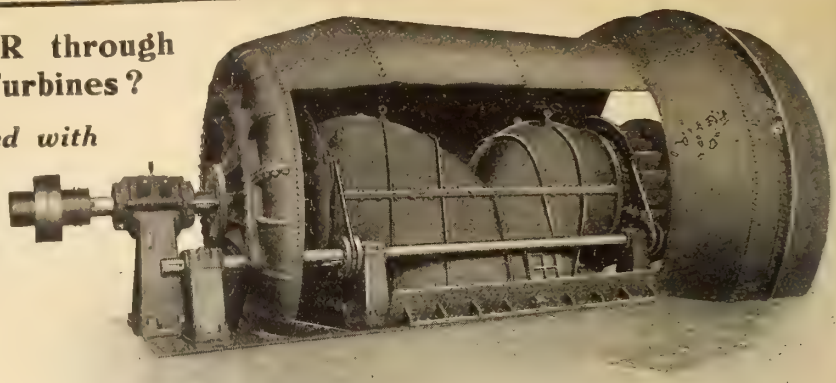
ARE YOU WASTING POWER through Inefficient and Antiquated Turbines?

Maximum Efficiency Assured with

"SMITH" HYDRAULIC TURBINES

The accompanying illustration shows a horizontal shaft unit of 2000 H.P. capacity under 42' head. Write Dept. "N" for Bulletin.

S. MORGAN SMITH CO.
YORK, PA.
H. B. Van Every, 405 Power Bldg., Montreal



Tenders Wanted

should be advertised for in the "Tenders and For Sale Department" of the CONTRACT RECORD AND ENGINEERING REVIEW. This paper is the "Tender Ad." medium of Canada and always brings bids from the reliable contractors and supply houses. File your plans for any work on which you are inviting bids in our offices at Toronto, Montreal, Winnipeg or Vancouver.

Contract Record
and Engineering Review
TORONTO - ONTARIO

DIRECT READING OHMMETERS

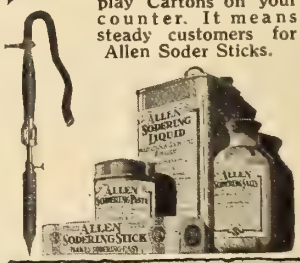


Thompson-Levering Co., Philadelphia, Pa., U.S.A.

ALLEN FLUX
NON-ACID—FOR SODERING

at it since '93

Be sure to have one of Our Handsome Display Cartons on your counter. It means steady customers for Allen Soder Sticks.



Allen Fluxes are the only ones approved by the National Board of Fire Underwriters!

Bissett & Webb
126 Lombard, Winnipeg, Man., Canada

For Underground Work

BITUMINIZED FIBER CONDUIT

has properties not possessed by any other type of Conduit made, which recommends it particularly for Underground Systems of Distribution.

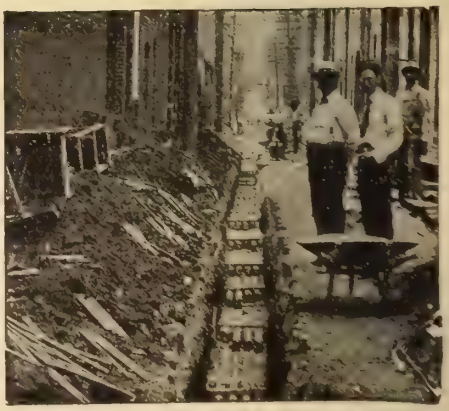
EASY TO HANDLE — LOW FIRST COST
EASY TO INSTALL — LOW INSTALLATION COST

7 foot Lengths — ⅜ inch Walls — ⅝ inch Socket Joints
Absorption, 100 Hours, less than 1 per cent. — Puncture Test 50,000 Volts

Electrolysis-proof — Water-proof — Gas-proof

Write for literature

American Conduit Company
East Chicago, Ind., U.S.A. — 140 Nassau St., New York City



Installing a Trunk Line Subway



FROM Halifax to Vancouver advertisements similar to those shown above are now appearing in commanding space in the leading Daily Newspapers.

Their purpose is the encouragement of reputable Home Industry for the benefit of the Public, the Manufacturer, and YOU, Mr. Retailer! What are **you** doing to promote Made-in-Canada Goods? Are you allowing inferior articles to hurt your market and your good name—or are you supporting, to the best of your ability, a movement that means **Better Business** and **Increased Prestige** for your store?

Try out the proposition! Keep your Benjamin line complete—reap the benefit of the advertising we are doing and help to accomplish this important object!

Insist on Benjamin **Products**

Two-Way-Plug

ELECTRIC LIGHTING SPECIALTIES *INDUSTRIAL LIGHTING*

Made in Canada by

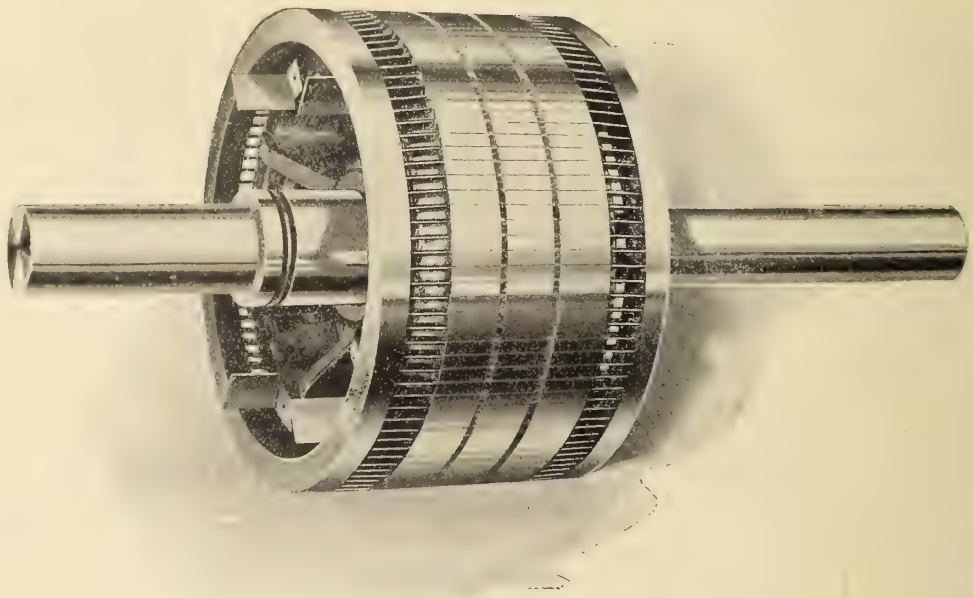
Benjamin Electric Manufacturing Company of Canada, Limited

11-17 Charlotte Street, Toronto

If Interested, tear out this page and place with letters to be answered

War Time Motors

As designers and builders of Motors since 1888 our watchword has always been "DESIGN!" Today, therefore, Crocker-Wheeler Motors come to you equipped to give that solid, steady, ungrudging 100 per cent. efficiency—standing abnormal strains with even less than normal attention—that your war-time work demands.



Cast Welded Squirrel Cage Rotor

"The design's the thing," say our Engineers

Note the efficiency design of this Crocker-Wheeler Rotor — the solid metal winding allows no loose joints. There are no bolts, rivets or screws to come away—no sparking or arcing at bars or rings.

"In-built Service" our workshop practice

Let us send you our latest Bulletin—No. 1000

THE CANADIAN CROCKER-WHEELER CO. LIMITED

Manufacturers and Electrical Engineers

Head Office and Works
ST. CATHARINES, ONT.

District Offices
MONTREAL TORONTO

G. M. Gest, Limited

Contracting Conduit Engineers

Head Office
Power Building
Montreal

Vancouver *Winnipeg*

FERRANTI



Pole Type Transformers

Single and Three Phase

HIGH EFFICIENCY—
LOW CORE and COPPER LOSSES

Write us for Prices and Delivery before ordering elsewhere.

House Service and Power Meters, Ammeters, Voltmeters, Current and Potential Transformers supplied from stock.

Ferranti Electrical Company of Canada, Limited

90 Sherbourne St. TORONTO
704 Unit Bldg. MONTREAL
592 Notre Dame WINNIPEG

FERRANTI FERRANTI FERRANTI

Are you interested in the remarkable development which has been going on in the

I-T-E CIRCUIT BREAKER

during the past year or two?

The scope of our work enables us to supply **practically standard breakers for special service.** We submit that the circuit breaker art of the world is what we have made it. A search of the Patent Office records will prove this statement, or an easier way might be for you to look at any recent notable installation.

Take the Equitable Building in New York, for example, or the Lumber Exchange and the Conway Building of Chicago, or the wonderful equipment of the Ford Motor Company.

The Cutter Company
Bank of Hamilton Building
Toronto, Ont.

Main Office and Factory:
Philadelphia, Pa.

New York, 50 Church St.
Detroit, Mich., Ford Bldg.
Indianapolis, Ind., Telephone Bldg.
Chicago, Monadnock Block.
Pittsburgh, Park Building.
Minneapolis, Metropolitan Life Bldg.
ECCLES & SMITH CO.
Los Angeles San Francisco
Portland, Ore.



Northern Aluminum Co., Ltd.
1305 Traders Bank Building
TORONTO, ONT.

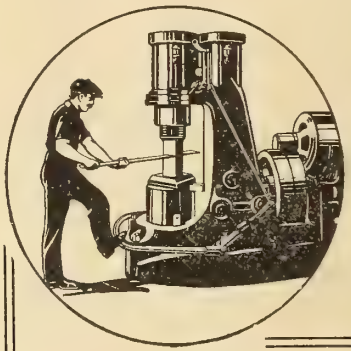
Manufacturers of Aluminum

Ingot, Sheet, Tubing, Wire, Rod, Rivets, Moulding, Extruded Shapes, also Electrical Conductors all Aluminum and Steel Reinforced

Litot Aluminum Solders and Flux

will solder aluminum to itself or other metals

WRITE FOR INFORMATION



Give It the Pressure Test

Spaulding HARD FIBRE

Put a sheet of Spaulding Hard Fibre under a steam hammer or test it any other way you will for compressing strength. You'll find that its compressing point of 38,000-42,000 lbs. per square inch is in the fibre as well as in the advertising.

A Material of Unlimited Possibilities

Its electro rupture is 200-400 volts per 1/1000 in. of thickness; tensile strength 10,000-20,000 lbs. per square inch; compressing point, 38,000-42,000 lbs. per square inch; shearing strength 9,000-13,000 lbs. per square inch. It can be machined, sawed, stamped, bent, threaded, drilled and finished in many attractive ways, worked up into practically any shape for unlimited purposes.

Made in red, black and grey colors. Send for samples. Our Specialty Department is equipped to machine special parts to your own specification.

J. Spaulding & Sons Co., - - Tonawanda, N. Y.
SUBURB OF BUFFALO
449 Broom Street, New York City.
166 Clinton Street, Chicago, Ill.

Tenders

A few dollars spent in advertising your proposals in

The Contract Record

would result in additional competition, which might save your city or town or your client many hundreds of dollars.

Mr. Manufacturer:

Perhaps not this year, but before many months, peace is almost certain.

It will mean a readjustment of trade.

War orders will cease, and manufacturers will be dependent upon their regular lines.

The manufacturer who has kept his name and his products before his possible customers will be in the strongest position. Good-will cannot be built up in a day.

Now is the time to start an aggressive advertising campaign, to get back the customer you may have unavoidably lost through war contracts.

Let us submit you a proposition to place before the electrical interests of Canada.

Service Department
The Electrical News
347 Adelaide St. West
Toronto



MENOMINEE Electric Bells

are ringing satisfaction all over the continent

Menominee Bells give the maximum volume of sound on the smallest current values. They are positive in operation, faultless in construction, handsome in appearance, and satisfactory in every detail. Write for complete catalogue to

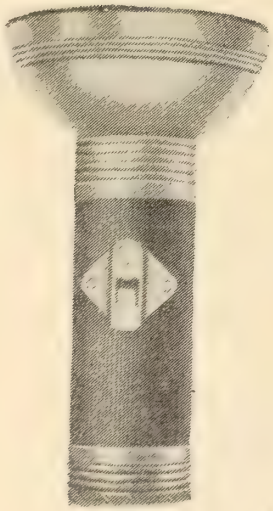
R. E. T. PRINGLE, LIMITED

95 King Street East, TORONTO

703 Confederation Life Bldg., Winnipeg **401 New Birks Bldg., Montreal**

402 Vancouver Block, Vancouver, B. C.

Write us for our New Catalogue



"EMPIRE"

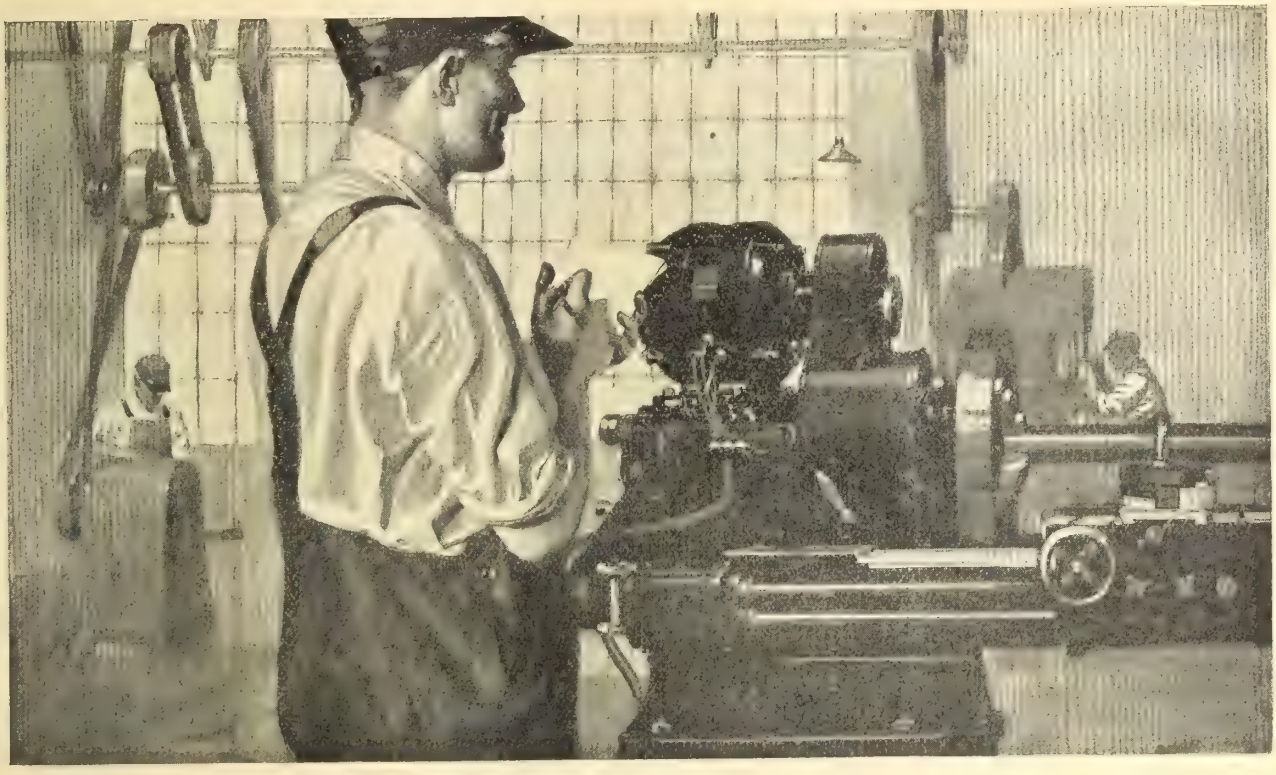
Showing a complete range of Flashlight Cases and Bulbs. We also specialize in Clusters, Sockets, Auto Bulbs, Xmas Tree Outfits, etc., at prices which should interest you.



"EMPIRE"

Canadian Import Sales Company

34 Front St. W., Toronto, Ont.



The Workman's Time Ticket Tells the Story of R & M Motor Reliability

Where machines are equipped with R & M Motors, their unfailing reliability enables the workman to get maximum production from his machine every hour of every working day. The worker's earnings and the factory output are maintained at top value.

As a result, everyone concerned—mechanic, foreman, superintendent and general manager—all take an interest in the story told on the workman's time ticket and the motors back of the production records.

Where such conditions obtain the man who sold the motors is always a step ahead of his competitors when new equipment is required. As a help in making the sale, he has the good will of everyone in the plant, from the workman at the machine to the general manager.

Central stations, jobbers and dealers find R & M Reliability an asset in their business of constantly increasing value.

THE ROBBINS & MYERS CO., SPRINGFIELD, OHIO.

New York, Philadelphia, Boston, Buffalo, Cleveland, Cincinnati, Chicago, St. Louis, San Francisco.

CANADIAN DISTRIBUTORS

The Century Electric Co. Montreal
Costello & Crowe Ottawa
Dawson & Co., Ltd. Montreal
La Cie Codere & Fils, Inc. Sherbrooke
Mechanics Supply Co., Ltd. Quebec
Eastern Electric Co. St. John
John Starr Son & Co., Ltd. Halifax
Great West Electric Co. Winnipeg
Rogers Electric Co., Ltd. Toronto

Robbins & Myers Motors

CONDULETS

Condulets are made in special water-proof types and meet every marine wiring requirement from ordinary elbows to junction boxes, lamp outlets and high capacity plugs and receptacles.

The few illustrations here given only suggest the lines. Why not write to-day for complete literature? We will gladly send it to you free.



TYPE VS WATER-TIGHT HAND LAMP



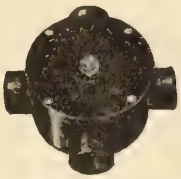
OIL TANKER 'REGINOLITE' WIRED THROUGHOUT IN CONDULETS



TYPE VL MOISTURE-PROOF CONDULET



TYPE SCX PROJECTOR 1,000 WATT



TYPE PNX WATER-TIGHT JUNCTION BOX



TYPE AD WATER-TIGHT JUNCTION BOX



TYPE BRHD WATER-TIGHT PLUG RECEPTACLE EQUIPMENT



TYPE LB OBROUND CONDULET BODY WITH BLANK METAL COVER



TYPE LR OBROUND CONDULET BODY



TYPE SDA PROJECTOR

Crouse-Hinds Company

OF CANADA, LIMITED

Toronto, Ontario, Canada

Electrical News
Generation, Transmission and Application of Electricity

Published Semi-Monthly By

HUGH C. MACLEAN, LIMITED

HUGH C. MacLEAN, Winnipeg, President.
THOMAS S. YOUNG, General Manager.
W. R. CARR, Ph.D., Editor.

HEAD OFFICE - 347 Adelaide Street West, TORONTO
Telephone A. 2700

MONTREAL - Telephone Main 2299 - 119 Board of Trade
WINNIPEG - Tel. Garry 856 - Electric Railway Chambers
VANCOUVER - Tel. Seymour 2013 - Winch Building
NEW YORK - Tel. 3108 Beekman - 1123 Tribune Building
CHICAGO - Tel. Harrison 5351 - 1413 Gt. Northern Bldg.
LONDON, ENG. - - - - - - - 16 Regent Street S.W.

ADVERTISEMENTS

Orders for advertising should reach the office of publication not later than the 5th and 20th of the month. Changes in advertisements will be made whenever desired, without cost to the advertiser.

SUBSCRIBERS

The "Electrical News" will be mailed to subscribers in Canada and Great Britain, post free, for $2.00 per annum. United States and foreign, $2.50. Remit by currency, registered letter, or postal order payable to Hugh C. MacLean, Limited.

Subscribers are requested to promptly notify the publishers of failure or delay in delivery of paper.

Authorized by the Postmaster General for Canada, for transmission as second class matter.

Entered as second class matter July 18th, 1914, at the Postoffice at Buffalo, N. Y., under the Act of Congress of March 3, 1879.

Vol. 27 Toronto, November 1, 1918 No. 21

Micawber as a Power Controller

The shortage of power which is being felt all over the Province of Ontario is most unfortunate, especially insofar as it interferes with essential industries. The mere curtailment of house, street or store lighting is a comparatively simple matter, which we could all accept gracefully if the exigencies of the war situation demanded it, but it's quite a different matter when munition factories have no power. Unfortunately, with both light and power fed from the same lines, it is impossible to disturb the one without at the same time cutting off the other.

Sir Adam Beck has stated time and again that some of the private companies could develop more power than they are using, and everyone is asking why the Hydro does not buy some of this power, or release some of their load to the companies. If the companies have a surplus of power it is reasonable to suppose they will sell it, and it was generally expected the Power Controller would exercise his prerogative and bring buyer and seller together on an equitable basis. However, this does not appear to be the direction in which he is working—if indeed he is working at all. He, possibly, has inside information telling him that Sir Adam's statements regarding surplus on the private lines is not correct. At any rate the only suggestion that has reached the public to date is that "perhaps" some of the power being exported can be withheld. This sounds unlikely, to say the least, as the U. S. is short of power, like ourselves, and overloaded with munition orders. Rather it looks like an attempt to gain time, and as if the Power Controller, not grasping the actual situation, not vigorous enough to take heroic measures, is hoping, with Micawber, that something will turn up.

It is a great pity the important office of Power Controller, at such a critical time, should be held by a man who, all too apparently, lacks the knowledge and training to enable him to see a solution which is evident enough to others. A lawyer holding an executive engineer's job would be bad enough in peace times, but is inexcusable now, and costing the province and, indirectly, of course, the British Empire, in both money and precious lives.

In the meantime the Power Controller waits for something to turn up.

Buy Victory Bonds

There are three reasonable and, we believe, unanswerable arguments why every Canadian should subscribe to the Victory Loan:

1. Loyalty—You will feel more at peace with yourself if you buy to the very limit of your possibilities, because you will know that you have done what a man ought to do who is proud of being a Canadian and a British Citizen.

2. Investment—Before the war such a gilt-edged investment as this is, yielded about 4 per cent. So it doubtless will be a few years hence. Think what a fortunate position you will be in five years from now to have your money earning 5½ per cent. when current rates for similar securities are about 4 per cent. That will also mean that your bond will be worth, if you want to sell it, considerably more than the par value you paid for it.

3. Prosperity—If we cannot advance money to England at the present moment to pay for the commodities she requires, she will be driven elsewhere to purchase. That would mean no more orders for the things we have to sell. Think what it will mean to the general business situation to have $500,000,000 distributed over Canada during the next few months. Think of the comparative dullness of trade if we don't have it.

Bonds can be bought in denominations of $50, $100, $500, or $1,000. Who is there in Canada to-day that cannot afford one or other of these? Don't hang back because you can't subscribe for a large amount. If every man, woman and child of our 8,000,000 population took the smallest bond of $50, that would mean a total of $400,000,000—more than the minimum asked for.

So whether you subscribe for a $50 bond only, or in thousands, remember—if you have done all you can—that you have squared your conscience, you have accepted a golden opportunity for investment, and you have done your share towards continuing the present lively prosperity of the country.

Public Utility Impertinence

A recent tabulation of the expenses of the average householder earning an income of from $1,000 to $2,000 shows that less than 3 per cent. goes for electric light and street car fares combined—that is from $30 to $60 a year.

This is one of the smallest sums entering into the annual expense account. It is comparable with the item of newspapers alone which, at a cost of 4 cents a day, (morning and evening), with a special on Saturday night, runs into the sum of $15.00. Of course we must not overlook the fact that the price of newspapers has doubled since the war began.

It is about the same as the price of shoes which at two pairs each for a family of four, averaging five dollars,

amounts to $40. (The price of shoes has advanced from 50 to 100 per cent. since 1914.) It is much less than the price of clothes, for which this typical family of four would require at the very least $200.00—an increase of more than 100 per cent., in some cases, since the war.

And what of the other items? Rent increased; every article of food—milk, bread, meat, sugar, vegetables—many of them cost more than double what they did in the old days. It truly is hard for the man of small means to make both ends meet. And the situation is all the more irritating and unbearable because there is evidence that many of the increases are pure profiteering—taking deliberate advantage of the times to raise prices more than increased costs justify. Taken altogether, it probably costs a man who formerly kept his family on $1,000, not less than $1,700 or $1,800 to live in the same way to-day—an increase not at all justified by the actual increased cost of the necessities of life.

In a number of towns and cities in Canada there are two items that have not advanced—electric light and street car fares, the items which, combined, cost the householder from $30 to $60 a year. Yet the cost of operating these utilities has greatly advanced, as can be seen by the average citizen, since this cost includes wages and materials, both of which are much more expensive. Is it any wonder if an electric light or a street railway system should make a request for an increase in the price of its product? Surely common justice demands a recognition of their claims, without argument. Indeed, this recognition has been made in a number of cities in Canada already and the rates and fares have been increased.

Yet, when the railway company in a large Canadian city asked, a few days ago, for an increase in fares, amounting to about 25 per cent., the mayor of that city called it "impertinence."

One cannot but wonder what his vocabulary produces when he pays for his boots, his suits of clothes, his top hats, his groceries, his coal, his meagre mid-day lunches!

But to sum up:

The commodity dealer in groceries, coal, rent, etc., is a free agent—has little at stake, assumes no responsibility, acknowledges no obligation, comes and goes as he likes—yet he squeezes his customers for all the trade will possibly stand, and they accept conditions cheerfully.

The public utility is tied by contract and franchise, has heavy financial obligations, assumes definite essential responsibilities, must work constantly and continuously to fulfill its obligations, is tied hand and foot over long periods of time, is held down at best to small financial returns—yet the public, if the mayor of this large Canadian city is representative, calls them impertinent when they ask a nominal increase for their products.

In a nutshell: The retailer of shoes, clothing, coal, rent, groceries, asks an increase of 100 per cent. which, in many cases, also means 100 per cent. or more profit—and we call it "war," "shortage," or what not. The public utility asks an increase of 25 per cent. which at best might represent a yield on investment of 5 or 6 per cent.—and it is "impertinence."

What do you think of the mayor's judgment?

Winnipeg Listening to Reason

The board of conciliation appointed to investigate matters in dispute between the Winnipeg Electric Railway Company and its motormen and conductors has recommended an increase in wages and in order that this increase may be paid the board has stated that the company should receive higher fares. The report further states: "It appears by the evidence before us that the company has paid no dividend to its shareholders since December, 1915, and at the present time, notwithstanding the elimination of jitney competition, the operating expenses and fixed charges of the railway exceed by several thousand dollars per month the railway's actual earnings. . . . In justice the public should pay an adequate war compensation for a service which cannot be rendered except for war prices." The wage increase recommended is as follows: 39 cents an hour for the first six months; 41 cents for the second six months; 44 cents for the second year, and 47 cents for the third and succeeding years of continuous service. Time and a half for overtime is also granted.

BUY VICTORY BONDS

EVERY squadron commander in the Royal Air Force in France is a Canadian. How many bonds can you take?

Electrical Supply to Military Hospitals

The Department of Public Works have received tenders for the construction of a light and power transmission line at St. Anne de Bellevue, P.Q., for the group of military hospitals recently erected there. Current will be supplied by one of the public utility companies from a point on the main road, near the buildings. The poles will be 30 ft. above ground, with 7 in. tops, and guyed at the turns and ends with standard guy wire and anchors. The cross-arms are to be of the standard 4-pin type, fitted with locust pins, double cross arms being used at the turns and ends. The insulators are of the double petticoat type. The primaries at the pole connecting with the company's lines will be protected by multi-gap lightning arresters. The line wire is to be double-braided.

The pole transformers will consist of seven lighting and four power transformers. The former, ranging from 5 to 50 kv.a., step down, will be single phase, oil-cooled, 60 cycle, with primaries of 2,200 v., and secondaries of 220/110 v., three wire system. The power transformers are of the same type, the primaries being 2,200 v., and the secondaries 550 v., connected in pairs for three-phase, 550 v., distribution. All transformers are to have an efficiency of 98 per cent. at full and half and 97 per cent at 25 per cent load.

Government Has Made Formal Protest

It is announced from Ottawa that the Canadian Government has made a formal protest to Washington against the action of the International Waterways Commission in granting permission to the St. Lawrence Power Company to dam the south channel of the St. Lawrence River at Long Sault, and an Order-in-Council has passed outlining the position of the Canadian Government. Canada takes the stand that under the Ashburton treaty, and the later treaty of 1909, it is definitely stated that navigation in the boundary waters is not to be interfered with. The Government is of the opinion that in view of these treaties the International Commission exceeds its rights in assuming the responsibility of giving authority to proceed with the weir.

The Hamilton Hydro-electric Commission have granted a war bonus of 20 per cent. to all women employees drawing less than $1,000 a year and 20 per cent. to all male employees receiving less than $1,200 per year. The bonus dates from October 1 and is for one year.

The city council of Brantford, Ont., will submit to the electors next January a by-law authorizing a debenture issue to the amount of $100,000 for the purpose of extending the street railway tracks in the Terrace Hill district.

Possible Wartime Lighting Economies

Report of Committee on War Service of the Illuminating Engineering Society Before Recent Convention

Every citizen can assist the Fuel Administration in its efforts to conserve the coal which must be saved if the war ability of the nation is not to be impaired. Principally this may be done by adopting good practice in house heating. To a lesser but important extent it may be done through careful economies in lighting.

This guide to economies in lighting has been prepared by the Committee on War Service of the Illuminating Engineering Society[1] at the request of the Fuel Administration extended through the National Committee on Gas and Electric Service.

It is the patriotic duty of each citizen to see to it that no fuel is wasted in his service. The technical guidance here offered should make it possible for each to adopt lighting practice which will conserve fuel without impairing public welfare or diminishing useful accomplishment.

The following simple rules lead to the elimination of waste in lighting, both by limiting the use of artificial light to the minimum necessary number of hours per day, and by promoting the most efficient use of artificial light during those hours.

Elimination of Waste in Lighting

Do not light lamps when sufficient daylight can be had.

Extinguish lamps when leaving a room unoccupied even for a few minutes. Use pilot flames on gas lamps. They facilitate relighting and leave no excuse for failing to extinguish lamps when their light is not needed.

Do not use lamps which contribute merely to decoration.

Do not use more lamps or larger lamps than necessary.

Do not use all the lamps when part of them will suffice.

Use single large high efficient lamps rather than a number of small lamps.

In halls, bathrooms, etc., turn down gas lamps when full light is not needed. Use electric turn-down lamps or turn-down devices.

Do not use electric lamps of the carbon filament type where the more efficient tungsten filament lamps can be employed.

Do not use open-flame gas burners where the more efficient mantle burner lamps can be employed.

Do not use blackened electric lamps or broken mantles or discolored chimneys. New lamps are more efficient.

Do not use indirect or semi-indirect lighting fixtures in conjunction with dark ceilings which absorb a large part of the light.

Use light colored reflecting surfaces (ceilings, walls, etc.) wherever practicable. These reflect much of the light and make it possible to employ fewer or smaller lamps.

Clean lamps, shades, globes, windows, etc., thoroughly and often. Dirt absorbs light.

Consult the lighting company for advice as to best lighting practice and latest devices.

Use daylight during the war in preference to artificial light wherever and whenever possible.

Raise the shades to let in the daylight instead of lighting lamps.

Arrange window shades to admit maximum daylight when desired. A good arrangement is to have two rollers at the middle of the window, one drawing up and the other down.

Ceilings and upperwalls should be light colored and clean. Light colored surfaces reflect five to ten times as much light as dark surfaces. They conserve both daylight and artificial light.

Refracting or diffusing glass in windows helps to spread the light to distant parts of the room.

Whitened surfaces on building exteriors (especially about courts of high buildings) give more and better daylight in opposite buildings.

Keep windows and skylights clean. Dirty windows may absorb half the daylight.

Dust window screens frequently. Remove them as soon as the insect season is passed. They absorb one-third of the daylight.

Carry out operations requiring strong illumination near windows where plenty of daylight is available.

Arrange machinery, furniture, etc., so that daylight falls on objects to be seen—not on the eyes.

The considerations underlying these rules for economical lighting are as follows:

Fuel Consumed in Artificial Lighting.—The total coal output of the country this year is estimated at 700,000,000 tons. About 2½ per cent. of this is composed in the production of artificial light. Electric lighting requires about 12,000,000 tons. The net consumption of coal in gas lighting is smaller (to which, however, a large amount of oil is to be added).

Relative Efficiencies of Various Lamps.—Most artificial light is produced by consuming fuel. Whenever a lamp is extinguished, the consumption of fuel is diminished. A small lamp consumes less fuel than a large lamp. Inefficient lamps require more fuel for a given production of light than do efficient lamps. The gas mantle lamp will produce five times as much light as the open-flame burner for the same consumption of fuel. An intelligent choice of lamps therefore makes it possible to reduce the consumption of fuel.

Shades and Globes for Lamps.—Modern lamps are so brilliant that they may injure the eyes if used without protective equipment. Shades and globes conceal them from view, soften and diffuse the light, and, where desired, redirect a considerable part of the light in the direction needed. Shades and globes never increase the total quantity of light, but an efficient reflector will usually increase the light where it is needed. With such a reflector a smaller lamp may suffice, thus saving coal. The advice of the lighting company should be sought when selecting such equipment.

Painting.—As a rule, at least one-half, and sometimes practically all, of the light utilized in interiors is received by reflection from walls and ceilings. Good light tinted paint when fresh rarely reflects more than one-half of the light which falls upon it. The proportion of light reflected from good white lead and oil paint under average conditions diminishes by about 10 per cent. a year. The same is true of calcimine and similar coatings. It is apparent therefore that

[1] Underlying the accepted principles of illumination are requirements for safety, conservation of vision, aesthetics, comfort, convenience and economy. The Illuminating Engineering Society is committed to the preservation of these principles and to their application in lighting practice in the public interest. A number of recommendations here presented, particularly those advocating decreased use of light, are calculated to save fuel rather than to bring about most desirable illumination conditions. These are to be regarded solely as a war measure, justifiable in the present emergency, but otherwise not to be approved.

there is an opportunity for improving lighting efficiency through the employment of the best finishes for ceilings and upper walls. Painting white ordinary light tinted surfaces may increase the light reflection by as much as 50 per cent. Therefore in order to save fuel in lighting, wherever it is practicable paint ceilings white; employ light tints for the upper parts of walls; and use paint that is non-porous and easily cleaned.

Extravagant Lighting.—Extravagance in wartime is unpatriotic. It involves application for selfish purposes of money and energy necessary to winning the war. Lighting in excess of that which is necessary, and lighting for needless display of decoration at such a time is extravagant.

Display Lighting.—The question of illuminated advertising display is a part of the larger question of general advertising practically all of which involves consumption of fuel. The desirability of curtailing lighting of this character would appear to depend upon the necessity of reducing advertising in general.

Proper lighting display has a place in maintaining the morale of the people no less important than amusements and recreation. Display lighting also has a certain utility in providing necessary illumination. General and needlessly extensive display and inefficient methods of lighting display under present conditions are extravagant. In planning lighting of this character every economy of energy not inconsistent with reasonable effectiveness of the lighting should be sought.

Fallacies in Lighting Economies.—Removing reflectors or shades from lamps in order to "get more light" defeats the object. The raw light from glaring bare lamps is less effective than a smaller quantity of reasonably diffused light not exposed to the eye.

Attempting to economize by reducing the number of lamps or by using smaller indiscriminately is unwise. In nearly every case ample illumination is essential to useful accomplishment. The most successful conservation is elimination of waste of light, not reduction of use of light.

Where Not to Save Coal.—In wartime human energy and financial resources are to be conserved as well as fuel. Except in the greatest emergency it is unwise to save a little coal at the expense of waste of labor or impairment of health or menace to the safety of the public. Coal saved through the improvement of lighting equipment is clear gain. To diminish lighting standards in industrial plants, offices and other places where accomplishment depends in part upon vision is to reduce accomplishment or output. In such places, therefore, lighting should not be reduced. On the contrary, an increase in the standard of lighting may be the truest economy and in the best interests of the nation. The liberal use of light for protection of important property, munition factories, public works, etc., is likewise in the public interest, and under present circumstances no attempt should be made to save fuel through the reduction of such lighting.

Curtailment a Local Matter.—In an acute local fuel situation an absolute lack of fuel may result in largely curtailed activities. If there is no fuel, industry must cease. Such a critical situation obviously demands radical curtailment of lighting beyond anything which is contemplated for general adoption.

In certain localities in the height of winter there may be a power shortage due to abnormally taxed generating capacity. This likewise may necessitate local lighting restrictions of a more extreme character.

In either event, when such a situation occurs, the problem is a local one, the handling of which must be governed by the particular circumstances.

Specific Applications.—Intelligent application in any lighting installation of the suggestions contained herein will result in appreciable saving of fuel. In some classes of installation certain of these methods of saving have more conspicuous application than others.

Store Lighting.

The amount of fuel consumed in store lighting is of sufficient magnitude to make a consideration of possible economies worth while. Waste is usually due to causes rather easy of correction without involving a decrease in the effectiveness of the illumination.

Economies may be effected by:

1. Eliminating excessive illumination.
2. Avoiding the burning of lamps when not actually needed.
3 Saving the light wasted by dirty glassware, dark walls and ceilings and inefficient equipment.

I. Illumination in stores should be only that necessary to enable customers to see comfortably and plainly even where the closest discrimination is required to the end that they may make selections and judgments quickly and satisfactorily and to enable salespeople to perform their duties quickly and easily. The degree of illumination suitable for any particular case may be determined by actual trial through the use of more or fewer lamps or of lamps of greater or lesser power.

II. Lamps should be so controlled that only those actually needed will be in use at any time. In small stores this may be accomplished by controlling each individual lamp or cluster of lamps at the fixture. In larger stores the lamps farthest removed from the windows should be on separate circuits being switched on first as daylight diminishes, the outer lamps being turned on later as necessary. In all cases the greatest practicable use should be made of daylight.

III. The loss of artificial light due to dirty glasswares and dark or dingy ceilings and side walls ranges from 30 to 50 per cent. and may be avoided by renovation at necessary intervals. Ask your lighting company.

Large lamps are usually more efficient than small lamps and where practicable installation should be altered to consist of the fewest lamps from which uniform illumination may be obtained under the conditions of use. Show windows should be lighted by lamps with efficient reflectors; by the use of these it is often possible to save from 25 to 50 per cent. of the energy required for illumination without impairing the illumination in the window. Under no circumstances should bare lamps be visible from the street as this renders the eye less sensitive and makes a higher intensity necessary in the interior of the store, thus defeating the purposes for which these economies are urged.

Hotel Lighting.

It is suggested that waste in guest rooms be reduced to a minimum by having a notice, probably a card, placed near the door reading:

> U. S. F. A.
> SEAL
> "It is requested by the U. S. Fuel Administration that you kindly turn off the lights when leaving the room, and help save fuel."

All employees of the hotel, especially the housekeepers having charge of the guest rooms, should be cautioned to see that lamps are not left burning when rooms are unoccupied and that when rooms are being cleaned only necessary lights are turned on. Bell boys should be instructed to turn on only the main or overhead lamp when showing the guest his room.

In dining rooms where two systems of lighting are in use, such as overhead and table lighting, one of the two should be reduced or eliminated entirely. Where overhead

lighting is sufficient, table lamps solely for decorative effects should be done away with.

In public rooms such as cafes, lobbies, writing rooms, etc., the illumination should be reduced to a point consistent with comfort. All decorative lamps, around mirrors or on brackets, etc., not absolutely essential to produce illumination of a sufficient intensity to avoid feeling of undue depression or gloom should be eliminated.

While it is important as a measure of safety to keep stairways, passageways, and halls adequately illuminated, it should be remembered that hall lights burn long hours and in cases where convenience or safety is not menaced reductions as to number and size of lamps must be made.

Service rooms where lamps are allowed to burn constantly should receive consideration, for example in large barber shops where only a few chairs are in use lights over the other chairs should be turned off. In the kitchen only those parts of the room actually being used for preparation of food, washing the dishes and the like should be lighted.

Home Lighting.

What can be done in the home to conserve fuel? To answer this question let us ask what things in the home are done by means of fuel. Well, heating, cooking and lighting are mainly done by its use; and either directly or indirectly this fuel is mainly coal. So that to conserve fuel in either of these three uses there are two methods to be considered: (1) To make sure of the efficiency of the appliance used, and (2) To limit the time of its use to a minimum.

It may not be generally known that the percentage of fuel used in the homes of Americans for these three purposes is about as follows:

For heating (house and water) ...	87 per cent.
For cooking...	11 per cent.
For lighting	2 per cent.
	100 per cent.

Our specific purpose here is to consider the conserving of fuel in home lighting.

Home lighting is by means of two kinds of light—Natural or daylight, and Artificial light. To properly use the former is to aid in conserving the latter, which requires coal.

At periods near dawn and near dusk, and during the heavily clouded days we supplement daylight by artificial light; and many times we do this unnecessarily because we do not make maximum use of the daylight at hand.

Daylight. (A) Keep window panes cleaned; as much as half the light may be absorbed by thick films of dust.

(B) Keep insect screens dusted; when repainting use light colored paint instead of dark, and do not paint the mesh closed; or else use galvanized wire which is light in color and durable. Also, remove the screens as soon as the need for them has passed. Many screens stop one-third the light.

(C) Housewives will be reluctant to give up, even to a degree, their use of lace curtains; but some minutes of artificial lighting may each day be saved by a judicious use of these during very bright periods only.

In short, use daylight wherever possible in place of artificial light:

Early to bed and early to rise
Saves our boys, fuel and cargoes and lives.

Artificial Light.—It cannot be said, in general, that our homes are overlighted; but as first stated above, it is true that many of them use light inefficiently, and many of them are lighted overtime. It is desirable, therefore, to correct both of these wastes, and to be watchful against their recurrence. To this end, may we not get this habit: When we look at a lighted lamp let us consider the rays streaming from it as streams of coal made incandescent; and remember **so long as the light flows, the coal flows!**

If it sems difficult to get every member of the family inculcated with the habit of light saving, then much may be accomplished by appointing one of the younger members a Light Monitor, charged with the duty of seeing that no extra or wasteful light is used. He will probably enjoy the duty and responsibility.

Recommendations for improving the efficiency of the lighting will be given in later paragraphs.

Having our equipment efficient, and desiring to further economize in the use of artificial light, let us not so much strive for a less lighted room as for less rooms lighted. Can we not work toward the old idea of the common family lamp, having it modernly equipped and supplying adequate light for all surrounding it?

Recommendations.

1. Turn off all lamps not in use.
   Even if you are coming back in a few minutes, you can turn it on again. Pilot burners or wall switches will be found a great incentive to this practice where lamps are in intermittent use.
2. Clean lamps regularly. (Not merely occasionally.)
   Dirty shades and reflectors may reduce your light one-half. It is proved economy to replace dim electric lamps or broken gas mantles with new ones.
3. Keep lamps properly shaded.
   Lamps having proper reflectors will give best service. Unshaded lamps cause eye-strain. Poorly designed shades waste light. Consult your lighting company.
4. Use only modern lamps.
   Replace open-flame burners with mantle lamps. Replace carbon electric with tungsten lamps.
5. Regulate light for proper requirement.
   Use turn-down lamps for hallways, kitchens, bathrooms, etc., where night lights are required.
6. Avoid the use of lamps for decorative purposes only.
   This is a form of extravagance unsuited to war times.
7. Do not use large size lamps in small size reflectors.
   This results in exposed lamps and glare.
8. Do not use indirect or semi-indirect units with dark ceilings.
   Such ceilings absorb too much light, instead of returning it downward in useful directions.
9. Again—Do not use artificial light where natural light may be used.

Lighting Economies in Offices and School Rooms.

Very large economies in the operation of lighting systems in offices and schools may be effected by observing all of the precautions listed below, and this without reducing the general illumination, which is seldom of an intensity higher than that required for the conservation of vision.

Control of Lamps.—Operate the lighting units for a given area only when such area is in use. They should not be turned on during any part of the day when the natural lighting will suffice. Place the responsibility for such careful operation on designated individuals.

Parts of the room remote from the windows may require artificial lighting when natural light is sufficient near the windows. Connect the switches, if possible, so that the light sources may be turned on in rows parallel with the windows, and the artificial lighting thus used in the several sections only as is necessary.

Often the greatest waste occurs through the lighting of an unnecessarily large number of rooms during the hours of cleaning. Every building superintendent and janitor

should insist that lamps be lighted in a given area only when the cleaners are actively engaged there, and that the minimum number be turned on which will permit the work to be done properly.

Cards or signs should be displayed prominently in the various rooms requesting tenants to turn on only such lamps as are necessary to their work and urging that all lamps be extinguished when daylight will suffice and when the tenant leaves his office.

Reflecting and Diffusing Accessories.—Use bowl-frosted lamps with open reflectors and be sure that the reflectors are deep enough to protect the eye from the glare of the filament or mantle. Larger reflecting fixtures with glass diffusing bowls suspended below the lamps further soften the shadows and reduce the demand for local desk lighting. Indirect and semi-indirect fixtures produce the best conditions for vision in school rooms and offices.

Clusters of lamps under flat shades produce glare and distribute light ineffectively. The larger lamps are the more efficient. Therefore a lower wattage will suffice in a single large lamp with deeper reflecting or diffusing accessory.

Cleaning of Windows.—Windows should be cleaned at frequent intervals to allow the maximum use of daylight and limit the house of artificial lighting.

Painting of Light Wells.—Paint the light wells white. This may reduce the period of artificial lighting by several hours each day, and improve the daylighting at all times.

Removal of Window Screens.—Where windows of offices are screened, the screens should be removed just as soon as the necessity for their use has passed. They absorb a high percentage of the daylight and require artificial lighting to be turned on for considerably longer periods.

Cleaning of Fixtures.—Dust accumulating on school and office fixtures frequently reduces the intensity by 25 to 50 per cent. Clean the units regularly and at short intervals to insure maximum output for the fuel consumed.

Wall and Ceiling Surfaces.—White ceilings and, to a lesser extent, light colored walls add greatly to the efficiency of any office or school lighting system. The added diffusion of light is also particularly valuable here. It is necessary that ceilings, especially should be refinished whenever they become darkened. With indirect or semi-indirect lighting the refinishing of the ceiling and cleaning of the lighting units will frequently increase the intensity 50 to 100 per cent., permitting a reduction in wastage to the next lower size of lamp.

In offices and school rooms the requirements of vision are exacting. The occupants must view fine detail and work in one position for long periods. The light from a lamp therefore enters the eye constantly from one direction and will prove annoying and harmful if too bright. Reflections from polished surfaces and sharp shadows also interfere with vision. If the general illumination is from amply diffused sources of proper wattage, all individual desk lamps may be dispensed with.

Economies in Fuel for Industrial Lighting.

In almost every plant there is waste in the use of light, the elimination of which can be accomplished without retarding production, impairing the vision or menacing the safety of the employees. The principal sources of waste are the following:

Inefficient Lamps.—Replace carbon electric lamps by the modern efficient tungsten filament lamps. Substitute mantle burners for open-flame gas jets. These substitutions will result in a saving of three-fourths of the fuel used for a given candlepower.

Where clusters of lamps are employed under shades replace them by a single larger lamp with a suitable reflector. The larger electric lamps are the more efficient. A lower wattage may be used in a single unit than with a cluster.

Improper Reflecting or Diffusing Equipment.—Flat reflectors allow much of the light to escape to the walls instead of directing it to the work. They also leave the bright light source exposed to view and the glare interferes with vision, causing a demand for still higher intensities. Use reflectors of the dome or bowl shapes for greatest economy. Except where lamps are mounted in high bay areas use bowl-frosted lamps to reduce glare reflected from the work and to soften shadows.

Faulty Location of Units.—Space lamps close enough to give uniform lighting and with reference to the work, so as to avoid bad shadows. This permits the use of a minimum wattage in the general lighting and makes it possible to remove most drop lamps or local lighting. Drop lamps within control of the workmen are frequently burned by him throughout the day when no necessity exists.

Maintenance.—Keep lamps and reflectors free from dust by a regular schedule of cleaning at short intervals. In many factories dirty reflectors absorb half of the light produced by the lamps.

Have windows washed frequently. This will greatly improve the natural lighting and permit the use of daylight alone for more hours per day.

The Kaiser does not want you to Buy Bonds.

Keep ceilings and upper walls well painted in white. When dark or dirty they will absorb so much light that more artificial light must be furnished.

Wasteful Burning of Lamps.—So far as possible do all lighting from a general overhead system out of the control of individual workmen. Make some individual in each department responsible for seeing to it that lamps are lighted only in such areas and for such periods as necessary.

Areas at a distance from windows often require artificial light when natural lighting is sufficient near the windows. Switching arrangements should be such as to make this possible.

Table I.

	Foot-candles at the work	
	Ordinary practice	Minimum
(a) Roadways and yard thoroughfares	0.05- 0.25	0.02
(b) Storage spaces	0.50- 1.00	0.25
(c) Stairways, passages, aisles	0.75- 2.00	0.25
(d) Rough manufacturing, such as rough machining, rough assembling, rough bench work	2.00- 4.00	1.25
(e) Rough manufacturing, involving closer discrimination of detail	3.00- 6.00	2.00
(f) Fine manufacturing such as fine lathe work, pattern and tool making, light colored textiles	4.00- 8.00	3.00
(g) Special cases of fine work such as watch making, engraving, drafting, dark colored textiles	10.00-15.00	5.00
(h) Office work such as accounting, typewriting, etc.	4.00- 8.00	3.00

Note.—Measurements of illumination are to be made at the work with a properly standardized portable photometer.

Change of Address

The address of the Hessco Electric Manufacturing Company has been changed from 210 Adelaide Street West to 33 Church Street, Toronto.



The best attended banquet of electrical men in the history of Canada

Canadians Hear About the Goodwin Plan

of Merchandising Electrical Apparatus and Appliances—A Record Attendance Attests the Universal Interest Taken in the Goodwin Program by Manufacturer, Central Station, Jobber, and Contractor-Dealer Alike

The three-day convention of the executive of the National Association of Electrical Contractors and Dealers, scheduled to meet in Toronto, Oct. 14, 15 and 16, was postponed, owing to the epidemic of Spanish influenza. Special permission was obtained, however, to carry out the banquet part of the program, and on Tuesday evening, Oct. 15, some 275 electrical men, many from outside of Toronto, and a few from the eastern and western provinces, assembled at the King Edward Hotel to hear Mr. W. L. Goodwin.

The delegation from the National Association, in addition to Mr. Goodwin, included Mr. W. Creighton Peet, chairman of the National Association, Mr. James R. Strong, of New York City, chairman of the National Constitution Committee, and Mr. Samuel A. Chase, special representative of the Westinghouse Electric & Mfg. Co.

The banquet was held under the auspices of the newly formed Ontario Association of Electrical Contractors and Dealers. Senator Frederic Nicholls, president and general manager Canadian General Electric Company, whose influence and support were, in large measure, responsible for the success which attended the event, acted as chairman.

Senator Nicholls, in his introductory address, remarked that as a pioneer of the electrical industry in Canada, in which he had been engaged for thirty-five years, he felt honored to act as chairman at such a gathering. It was the largest and most notable gathering of Canadian electrical men in all his experience, and he congratulated Mr. Kenneth A. McIntyre, president of the Ontario Association, on the great success which had attended his committee's efforts. He then proceeded to point out what organization has done for Canada as a nation during the past four years. The war had introduced unprecedented conditions which had called for greater co-operation and more complete organization than had been known before. Such organizations as the Imperial Munitions Board had been formed and the resulting co-ordination of effort had worked most effectively to the benefit of Canadian industry, correcting the trade balance to a great extent, and producing wonderful prosperity. Such were the proven advantages of organization. Senator Nicholls said that having heard much of Mr. Goodwin's plan of organization for the electrical industry, he had come prepared to listen to Mr. Goodwin himself, with an open mind.

Mr. Goodwin's Address

"We have two very important jobs before us—we as electrical men. Our first job is to win this war, and that we are going to do without any shadow of a doubt, as we have the best organization in the field to do the job. It is said that food will win the war, but this is not so. It has been said that men will win the war, that money will win the war, that materials will win the war. These are catchy statements that sound all right, but the thing that will really win the war is organization, made up of all these things together. Next to the winning of the war we have the greatest responsibility, perhaps, of men of any industry, in the serving of the great masses of the people with electrical necessities and conveniences. No other industry contributes to such an extent to the progress, the success or the happiness of the people as does the electrical industry. Any other single industry might be left out of this war and the war would go on just the same, but take away the electrical industry and everything would stop immediately. Other industries make much of their contributions to the war—the automobile, the food and other industries tell us what they have

not but we are doing our work in silence and we will receive our just reward in due time. To the electrical people have been delegated the greatest responsibilities of serving the public, but I feel that in the past we have served them quite too well. Our effort has been selfish and individual. The great majority of electrical men do not realize their responsibility to the public; their sole idea is to profit. We give a great deal of time and money to charitable work, but do we realize that through the facilities which our industry offers human efficiency can be increased perhaps many hundreds of times, and that beyond the personal profit is the greater responsibility of serving the public. I do not know much about electrical conditions in Canada, but I do about the States. We have made very satisfactory progress. We are dealing with an unknown quantity and a great deal of credit is due to the pioneers, but we must do more. It is not generally known that the public has not been sold the electrical idea. Electricity in its various forms has been sold as a luxury. True, it has come into our industries as a necessity for lighting and transportation, but so far as its general use in the household is concerned, it is still considered a luxury. In the States, with a population of approximately 100 millions, the gross sales of our central stations approximate $300,000,000 per annum, or a per capita consumption of $3.00. In manufacturing, installation, and so on, the gross annual business is $500,000,000, making a total of approximately $800,000,000 or $8.00 per capita. This amount was no doubt exceeded during 1917, but when you consider that with perhaps three or four hundred thousand

BUY VICTORY BONDS

You are merely asked to LEND your money at a good rate of interest—on rock-bottom security. Compare this with what the boys are GIVING.

engaged in the industry we are only able to produce $800,000,000, and that the automobile industry exceeds the electrical industry by five or six times, then I say that as electrical people, we are not doing as well as we might.

"Our effort has largely been individual, and so believing I gave considerable thought to the question and made suggestions, and did some organization work in my own district, the Pacific Coast. There we had only a per capita consumption of $5.00 per capita, but we got the electrical people together, and in five years this consumption was increased to $30.00 per capita. If that rate could be extended in the States then we would have a gross annual business of $3,000,000,000 per annum, and all would participate in the rewards."

Mr. Goodwin said that the great difficulty was that the functions of the various branches of the industry had not been properly defined, that the manufacturer and central station had not assisted the retailer, but that the latter had actually been in competition with him, with the result that whatever business he got was at a low rate of profit. He referred to his own experience in the jobbing business and related how through co-operating with the retailer he had increased his profits in the ratio of 5 to 3 by increased volume of business and reduced overhead, while actually selling his goods at a lower rate. "I figure," he said, "that we are spending, in the U. S., perhaps ten or fifteen million dollars per annum to try and sell our products. If the same amount were expended through organizations co-operating in scientific distribution, it would easily raise our business to two or three billion dollars per annum in five or ten years."

"People are generally suspicious at first, this being particularly true of the electrical contractor. He has struggled with these obstacles for years and can't believe that jobbers and manufacturers, or central stations, are susceptible to change of policy. Since the plan was started in the States, however, hundreds and hundreds have changed and adopted an ethical policy of retailing, and it is working out. People are willing to try things to-day that they would not try a few years ago. Our campaign must be one of education. We must make business men out of the retailers, and when this is done you will find that many of the difficulties will have disappeared."

Driving around Toronto Mr. Goodwin had not been favorably impressed with the type of electrical stores. "There should be two or three hundred beautiful electrical shops in a city like Toronto. Of all the great industries in the world we are the only one that does not know what we are selling. We are selling an unknown quantity. We have not sold the electrical idea. There has been too much complication in our policies and too much effort expended in getting after unprofitable business. Our method of pricing in the electrical business is most unscientific. The value of the service rendered by the various factors has never been determined. No one seems to know the value of the service of retailers, whether it should be based on averages or sales of each commodity. We must have a scientific basis of price making before our distribution can be satisfactory. Price should be based on factory cost, plus reasonable profit, plus the cost of service rendered to the public. To my mind, a scientific price schedule for the sale of our commodities is required."

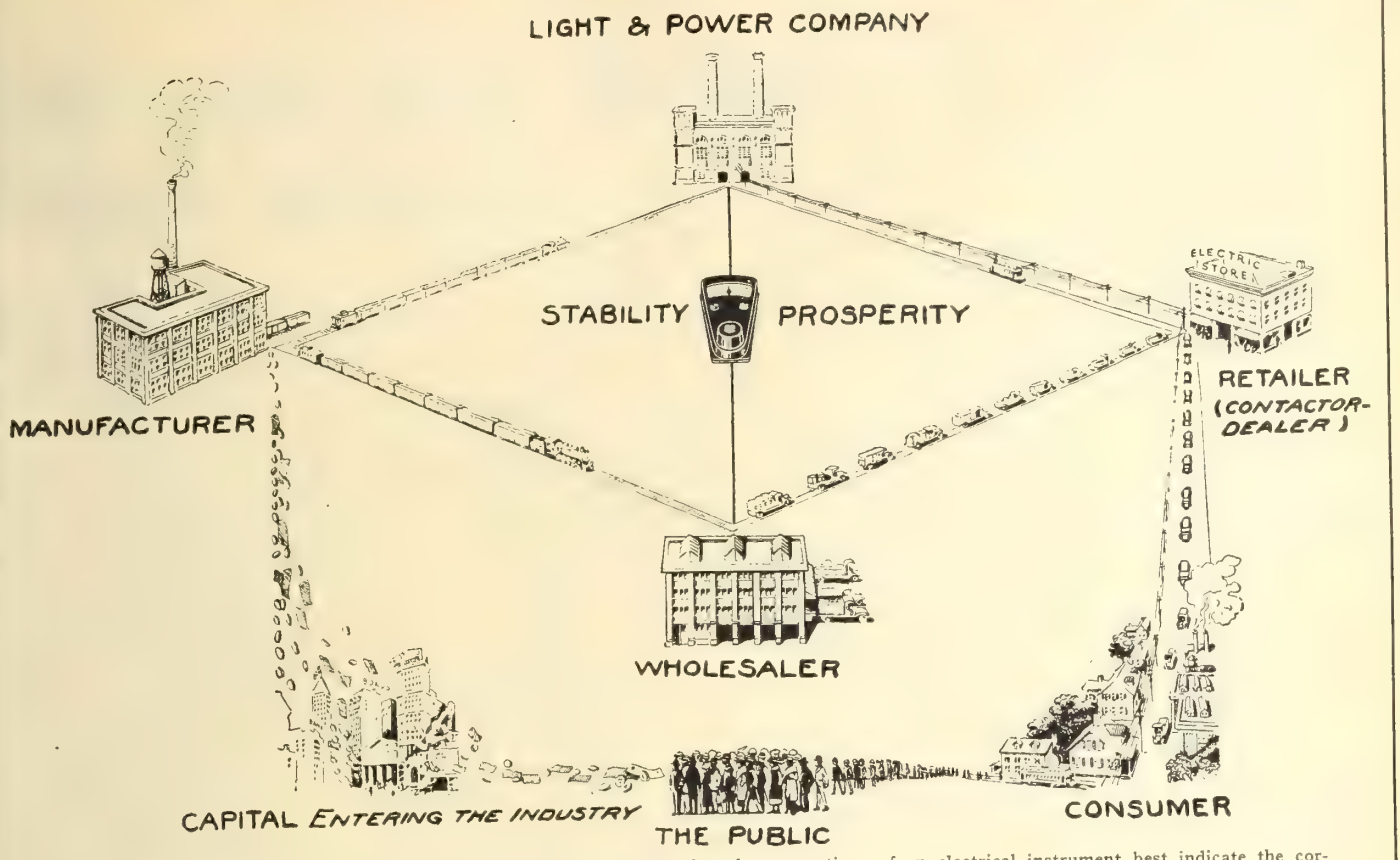
Mr. Goodwin pointed out the great difficulties which have arisen through lack of proper standardization. In the case of transformers, for instance, a legion of different types is required to supply all the various voltages, frequencies, etc., and there are some 5,000 different devices that may be used when wiring a building according to the choice of the architect or engineer. "Fortunately, through necessity of war, we are told we must conserve, and perhaps when we get through, we may have 300, instead of 5,000. We are being taught the lesson of co-operation and we are going to simplify our problem of manufacture and distribution.

"We have in the electrical industry a lack of proper organization in the four main branches. We have a lack of organization in the industry as a whole."

Mr. Goodwin proceeded to make same remarks on the value of organization, and told how the Wheatstone bridge had appealed to him as a particularly good illustration of how the various factors in the electrical industry should be co-ordinated. In this regard, he said:

"When Christie invented the Wheatstone Bridge in 1833, he little dreamed how significant it would become to the whole electrical industry. To-day it represents the scientific distribution in electrical merchandizing, and a brief study of the diagram will indicate how close this analogy really is. How particularly appropriate it is that the electrical connections of an electrical instrument best indicate the correct commercial relations in the electrical industry.

"The battery, the source of energy, represents the public, whose investors furnish the capital for all branches of the industry. This capital, the manufacturer converts into generating and distributing equipment for the central station or industrial plant, or into appliances and supplies. His sales diverge as shown in the diagram, dependent upon the principal class of product utilized by each branch. The central station has electric service as its principal product which, it will be noted, is used through the wiring installed principally by the contractor-dealer. The wholesaler has as his principal function problems affecting wholesale electrical



The Human Wheatstone Bridge—"How particularly appropriate it is that the connections of an electrical instrument best indicate the correct commercial relations in the electrical industry."

merchandizing. He makes contact with the central station or the contractor-dealer in passing to the consumer. The contractor-dealer thus becomes the point of retail contact of the manufacturer, central station, and wholesaler with the consuming public which, by the way, following the circuit, brings us back to the negative side of the battery, thus completing the analogy.

Nothing in the diagram indicates, nor is it the intention to restrain in any form, either of the interests referred to in performing the function of another, but due regard to the interests of all should be recognized in order that the scientific plan of merchandising under the Wheatstone Bridge principle will not indicate on the galvanometer such an unbalanced condition as now exists.

"When each interest operates with due regard to the interests of the others, the galvanometer will indicate at zero, an evidence of a balanced condition, which, when applied to electrical merchandizing and the electrical industry is reflected as stability and prosperity.

Solving the Problem of Distribution.

"With this explanation, you may now even ask the question:—How will the Wheatstone Bridge principle of electrical merchandising solve the problem of distribution and remove conflict of trade interests? My answer is:—It will not, unless applied by each individual concern and recognized as fundamentally correct by each branch of the industry. So this Wheatstone Bridge plan of merchandising is submitted as a scientific instrument analogous to the mariner's compass with the hope and belief that it will eventually be so recognized by the captains of the electrical industry.

A compass, in itself, does not navigate a ship along the right course, but it enables the captain to direct his ship along not only a safe course, but as well over the shortest and best route to his destination. So the Wheatstone Bridge when applied to wholesale or retail merchandising, should serve as the "compass" of our industry, enabling us to readily understand "Navigation" as applied to our intricate commercial problems of merchandising and distribution, causing us to navigate our commercial ship not only along a course free from the submerged rocks of friction and failure, but as well over a course marked with beacons indicating co-operation, organization and co-ordinated effort. When the galvanometer on the bridge indicates zero it will reflect to the industry in the form of stability and prosperity.

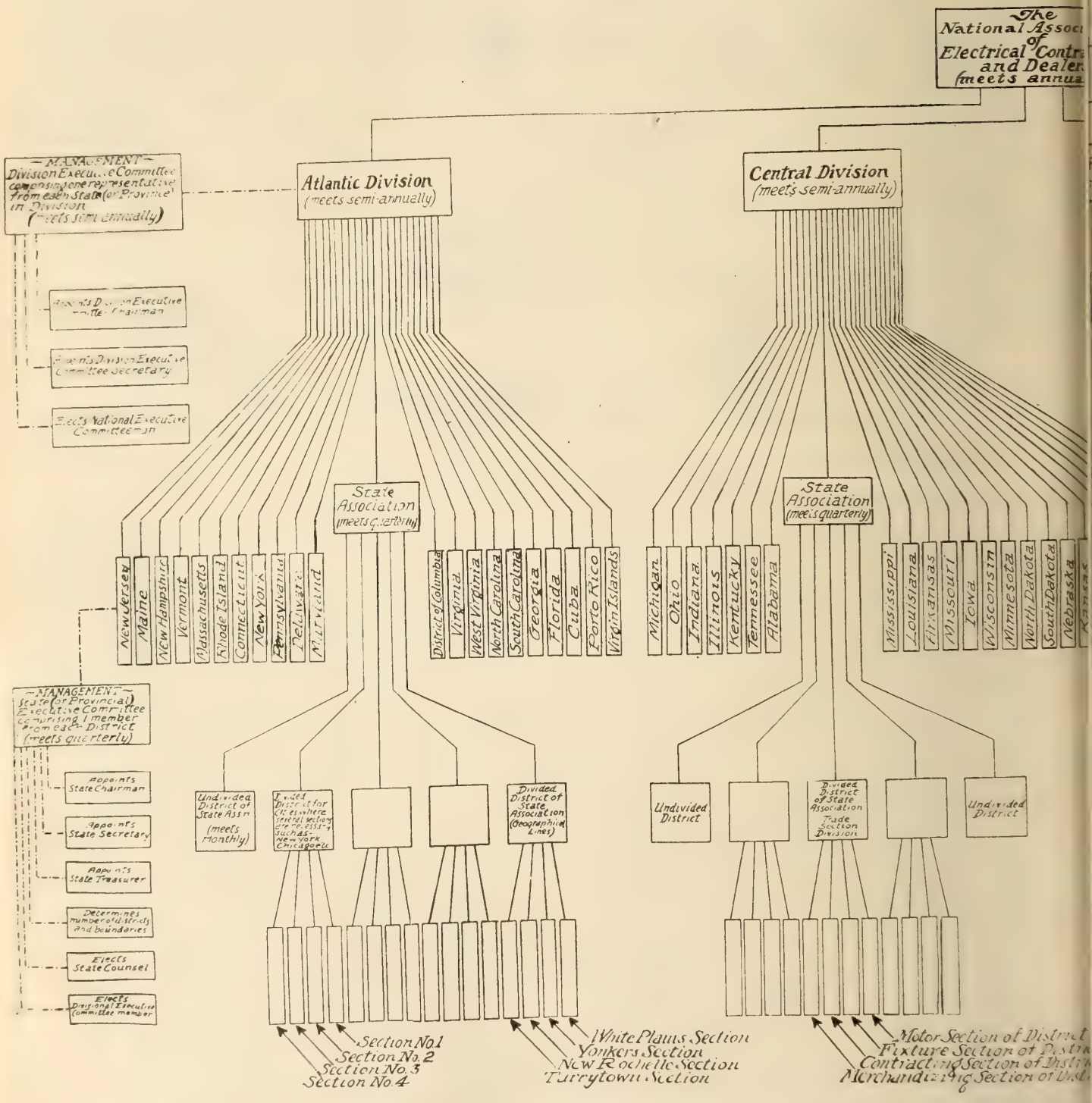
"Better electrical merchants will mean better business for all of us—contractor, central stations, jobbers and manufacturing alike. A sound merchandising plan that will improve conditions in the retail selling field is bound to benefit in general every group and individual in the industry. But in addition to the broad results that will come in this way, the movement can offer some very definite benefits to the lighting company, the wholesaler and the manufacturer. And the plan should be looked at from all of these viewpoints, for in this matter of retail merchandising lies the solution to a lot of the problems that have been confronting the industry as a whole.

"The central station, be it privately or publicly owned, for example, wants security of public opinion and increased kilowatt-hour business. The plan insures these very things for the central station.

"The jobber wants larger volume of sales, security of his position in the trade and with the manufacturer, better credit conditions, better collections and his customers to be better business men. The plan offers these to the jobber.

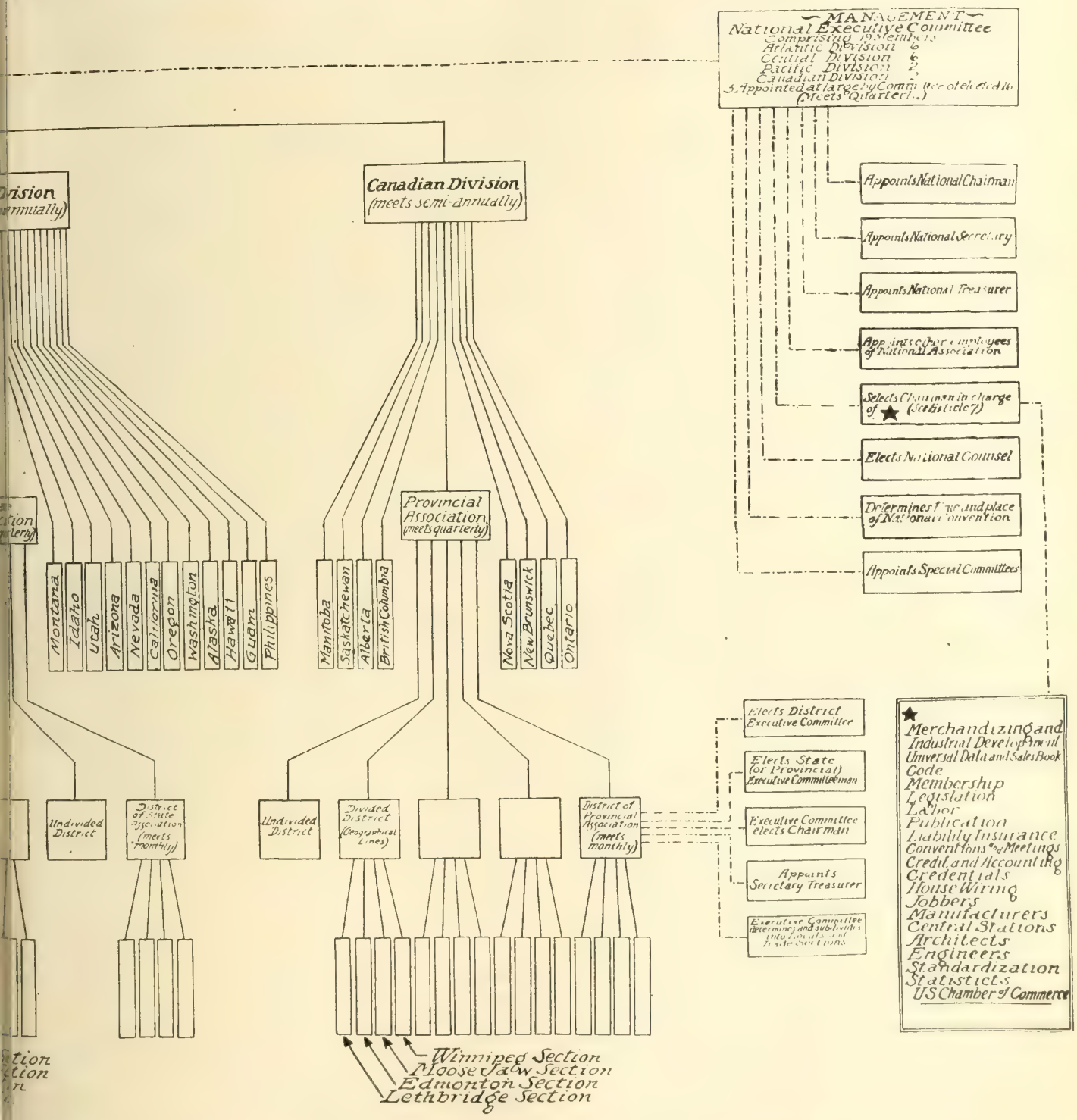
"The manufacturer wants simplification of his selling problem, lowered cost of distribution and selling, standardization and wider use of his products and security for his

National Association of El
Graphic Represe



The continent is subdivided into four main "divisions"—Atlantic, Central, Pacific, Canadian—so t and one national meeting each year. The divisions are sub-divided into states and provin the districts into sections such as motor, fixture, contracting, etc. The smaller the sub-div

Contractors and Dealers of Organization



eet together at points near which they are located. There will be two meetings of each division ub-division into districts where thought necessary. Provision is also made for again sub-dividing ent the meetings, which may be quarterly, monthly or weekly as conditions would determine.

business, and these are the offerings the plan holds out to the manufacturer.

"The contractors, therefore, in asking the sympathy and interest of the other branches can themselves take pride in the fact that they are getting ready to go before the industry with a plan which offers a great deal for the lighting company, the jobber and the manufacturer, if each of these groups will study, understand and apply it."

In conclusion, Mr. Goodwin said: "I appreciate very much this opportunity of addressing you, particularly as the invitation has come from Senator Nicholls, and I am sure he will be a supporter of any plan you may decide upon. I do not say that the electrical men of Canada should get together on this plan, but they should get together on some plan and work it out."

Mr. Chase Endorses the Plan

At the request of Senator Nicholls, Mr. Chase, special representative of the Westinghouse Co., addressed the meeting. Mr. Chase referred to the excellent work being done by Mr. Goodwin and his plan of education, stimulating the various branches of the electrical industry to get together and devise ways and means whereby better merchandising methods may be used. He urged all to have confidence in Mr. Goodwin and the plan of the National Association of Electrical Contractors and Dealers for re-organization, and not to lose time by asking each other: "What's the ulterior motive?" because the plan, if in operation, would be of benefit to all in the electrical industry—manufacturers, central stations, jobbers, contractors and dealers—and to the public as well, for the reason that the lesson they are endeavoring to teach is: "How can we most economically sell electrical merchandising goods through the natural channels of distribution? To depart from these natural channels would be as foolish as trying to change the flow of the St. Lawrence River.

Mr. Strong on "Organization"

Mr. Chase was followed by Mr. Jas. R. Strong, of New York City, who dwelt on the subject of "Organization," In order to give his audience a clear understanding of the situation he proceeded to give a little history regarding the National Association, telling how the beginnings of the present organization were formed in 1890 in New York City with a membership of eleven; how it had been enlarged to a state association in 1905; and how in 1910, still finding the organization inadequate, the New York State association had been instrumental in getting a number of prominent electrical contractors together and forming a national association. This association had made progress and in 1916 reached a membership of 1,500, covering most of the states of the Union, but still its scope was too limited, representing not 10 per cent. of the retailers in the electrical business. The officers were busy studying the problems of its improvement, "when suddenly out of the Golden West came the Moses who was to lead us out of our difficulties." This Moses (Mr. Goodwin) attended a meeting of the executive last June, when he presented a plan which was enthusiastically received. As a result a National constitution committee was formed, consisting of Mr. McClary, of Detroit, and the speaker, and to it was consigned the duty of revising the existing constitution.

Mr. Strong pointed out that there were two main differences between the old and the new constitution. The first change was the creation of an associate membership, in order to bring into the association those who did any retailing of electrical merchandise. To suit this action the name was changed to the National Association of Electrical Contractors and Dealers. This associate membership consisted of those who carried on electrical merchandising as a department of their business—jobbers or central stations who retail, and department stores with electrical departments. The member was one who was exclusively a contractor and dealer.

The second step was to adopt the principle of paying dues in accordance with the amount of business done. The members had been classified in groups from "A"—less than $12,000—to "J"—over $500,000—and each paid in proportion. Further classes had since been added, the highest now being "over the million." The contractor or dealer was permitted to classify himself, based on his sales during the previous calendar year. The object of this action was to interest the small contractor or dealer, and leave the membership of the association open to him for a small fee, and the scheme was working out very satisfactorily.

Plan of Organization

Mr. Strong then referred to his organization chart which is reproduced elsewhere on pp. 30 and 31 of this issue—a new one to which the Canadian Division had been added. He pointed out that the reason for making the four divisions was that members might meet together at centres near which they were located. There would be two meetings of the divisions, and one national meeting each year. The divisions were sub-divided into state associations, the provinces of Canada being considered as states for purposes of constitution, and there was a further sub-division into districts, if necessary. Provision was also made to sub-divide the districts into sections, such as motor, fixture, contracting, etc.

In the distribution of data, etc., the channels worked downwards from the National Executive to the section, while the method was reversed in the collection of fees, the money passing up through the district, state and division, each appropriating it proper share. To provide for proper representation, there would be six committeemen elected to the National Executive from each of the two larger divisions, the Atlantic and the Central, and two from each of the two smaller divisions, the Pacific and the Canadian. The state associations in turn elected committeemen to the divisions, and the districts to the state associations.

Mr. Strong also referred to the special committees which had been formed to collect and distribute information that would be useful to all the members—such as industrial development, universal data and sales book, national electrical code, membership, legislation, publication, liability insurance, conventions and meetings, credit, credentials, house wiring, merchandising, etc. All this organization work had been accomplished in a short time, and there were now ten state secretaries giving their entire time to association work. It was held that these secretaries should be paid men; past experience shows that in no other way could the work be carried out satisfactorily. The secretaries attended to the technical and detail work, while the officers were responsible for the policies. At the last meeting of the Executive Committee, the appointment of a general manager of the National Association had also been authorized. Mr. W. H. Morton, formerly of the J. & M. Electric Co., of Utica, N. Y., and who had also been secretary of the old association for fourteen years, was chosen for this position.

Broadly speaking, the fees collected were used to increase the membership and to discover and assist those members who were not carrying on their business properly, sending them information and having experts call upon them to discuss their problems and point out how their methods might be improved. To assist in this object, a questionnaire card had been used with a number of enquiries as to methods, etc.

Another question which had come before the National Executive Committee was that of establishing a Bureau of Education and Research, and the speaker felt sure that at

the next meeting of the committee this step would be decided upon. By means of this Bureau it was hoped to interest those outside the association. It was also its object to educate the electrical retailers and the general public in the economical and safe use of electricity and electrical devices, to prevent the danger of fire through careless handling, and to promote the conservation of electricity during the war, to compile and distribute data on the cost of operating appliances, safe installation, etc.; and to compile this information in such form as to be readily available for making sales.

In closing, Mr. Strong made a few remarks on the value of organization, pointing out that it produced good fellowship and presented a means of mutual education. "None of us," he said, "are too old to learn something from organization."

Mr. Hayward Speaks for Vancouver

The chairman next introduced Mr. E. C. Hayward, of Victoria, B.C., Vice-President of the British Columbia Association of Electrical Contractors and Dealers. Mr. Hayward extended to those present the hearty greetings of the association he represented. He said that his association had been in existence for the last two years, and that a month previously they had resolved to affiliate with the National Association. He therefore tendered to Mr. Peet, its chairman, their offer of affiliation. Mr. Peet, in replying, expressed much pleasure in accepting the offer, and said he only regretted the National Executive Committee was not present to receive it.

Kenneth A. McIntyre—The Man Behind the Gun

In introducing Mr. Kenneth A. McIntyre, president of the Ontario Association of Electrical Contractors and Dealers, Senator Nicholls said that Mr. McIntyre had worked very hard indeed in order that this notable gathering might be an accomplished fact, and that supreme credit was due him for his efforts. Mr. McIntyre modestly deprecated the chairman's flattering remarks, and explained how it had been through the influence of Senator Nicholls and his invitation to Mr. Goodwin to address the gathering that such success had been made possible. He explained that his association had followed practically the same plan of organization as the National Association, only adjusted a little to suit the Ontario Act. Envelopes containing full information and directions as to joining the Ontario Association had been provided for the use of non-members and he trusted that a large number of them would join right on the spot. In closing, he tendered to Mr. Peet his association's offer of affiliation.

Mr. Peet, in reply, said that he felt in a way that he was making history. He took credit to himself for inviting Mr. McIntyre to Detroit to the National Executive Committee meeting, and said that at that time he and his associates were very much impressed with Mr. McIntyre's enthusiasm for the movement.

PHOTOGRAPHS OF THE BANQUET

Photographs of the Goodwin banquet, 11 x 14 in., mounted, may be obtained from the president of the Ontario Association of Electrical Contractors and Dealers, Mr. Kenneth A. McIntyre, at $2.00 each; by mail 10c extra.

The Regina street railway system shows a deficit of $42,405 for the first nine months of the year, according to a statement just prepared. The electric light department shows a deficit of $16,490 for the same period.

Hydro Development on Riviere des Prairies

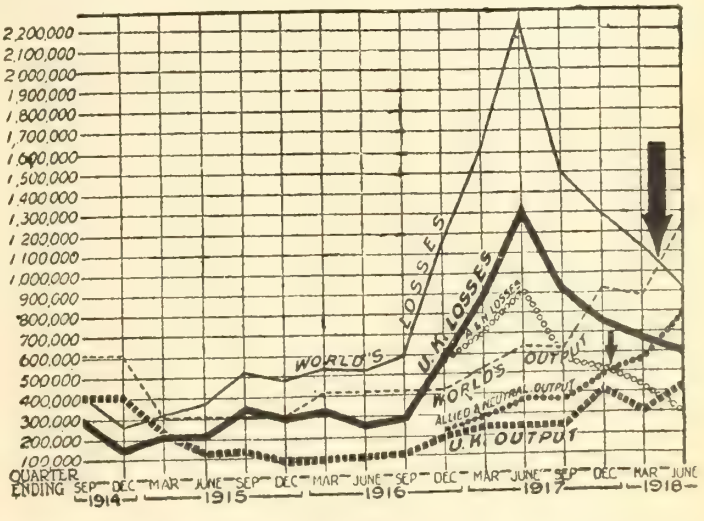
A company, headed by Senator M. J. O'Brien, of Renfrew, with Messrs. Quinlan and Robertson, contractors, Montreal, have sought authorization from the Quebec Government to proceed with a Hydro-electric development on the Riviere des Prairies, Island of Montreal. The preliminary plans, drawn up by Mr. Henry Holgate, consulting engineer, Montreal, provide for a development of 40,000 h.p. Federal sanction has already been obtained, subject to modifications of the original plan, and provincial authority is required for use of the bed of the stream.

It is proposed to construct an arc shaped dam, starting on the Montreal side below the Viau bridge, and continuing in a straight line on the other side of the river to Sergeant Island and to the north shore of Visitation Island; from there the dam will run to a point just below Cheval de Terre Island. The power house will be on the south shore of Jesus Island, and the preliminary plans provide for nine units.

The project will raise the water level some 15 feet and will interfere with the sewer outlets of Montreal. When representatives of the company asked the Quebec Government for the requisite authority for the work, the city of Montreal raised the question of damage to the outlets. The company's representatives expressed a desire to meet the city on this point, and the Premier therefore suggested that the company and city get together and settle the question of reconstruction and financial responsibility. When this was agreed upon, the company should again see the Government for permission to proceed with the scheme.

The Naval Situation

The diagram below, which is taken from the Daily Mail, of London, England, illustrates very clearly the trend of the world's shipping output, and the losses due to enemy submarines, from September, 1914, to June, 1918. It will be



observed that at the point of time marked by the arrow, in April or May last, following a comparatively sudden decrease in losses, the output rose above the sinkings. In allied and neutral shipping, the output began to overbalance the losses at the earlier date marked by a smaller arrow. Now that we have the confidence of a satisfattory conclusion of the war, we can look back and consider the seriousness of the situation which confronted us when the Hun's piracy had reached its peak in June, 1917. At that date the sinkings of shipping belonging to the United Kingdom alone were more than double the world's total output and about five times the British output, while the world's production was considerably less than one-third of its losses. The British position, even as late as last June, does not appear very satisfactory

Manufacture of Heating Appliances is Restricted in the United States

The War Industries Board of the United States, in order to conserve essential materials and labor, to free capital tied up unnecessarily in manufacturers' and merchants' stocks, and to simplify and standardize factory production, has issued a schedule for manufacturers of electrical appliances which calls for the discontinuance of the manufacture of the following:

List to be Discontinued:

Carburetor heaters, hand-wheel heaters, in-take heaters, manifold heaters, primer heaters, blankets, robes, cigar lighters, frying pans, plate warmers, curling irons, saute pans, waffle irons, fluting irons, egg boilers, soup kettles, stew pans, corn poppers, hand dryers, hosiery forms, peanut roasters, transfer irons, vaporizers, varnish sprayers, entree dishes, cigar lighters for automobiles, bookbinding appliances, instantaneaus water heaters, automobile foot warmers, fudge warmers, vegetable dishes, and all Sheffield plated ware.

The schedule for domestic appliances (600 watts or less, except ranges) provides:

All appliances that are to be eliminated, but which are now in the process of manufacture or are completed in stock may be sold, but no more material for any of these appliances to be purchased except to balance up stocks on hand, and their manufacture is to be discontinued entirely Dec. 31, 1918.

Output to be Restricted.

Industrial appliances (over 660 watts).—Each manufacturer of the following appliances to restrict his output to the number of styles and sizes specified:

	No. of styles	Total No. of sizes
Convection air heaters	3	7
Confectioner's appliances	2	2
Corset irons	1	1
Matrix dryers	1	1
Tailor's irons, 12 lb. or over	2	4
Laundry irons, 7½ to 10 lb.	1	2
Gluepots (no aluminum pots to be made)	1	3
Circulation water heaters	2	11
Immersion water heaters	1	8
Round disk hot plates, opencoil type	1	4
Dound disk hot plates, open coil type	1	4

Steam boilers: To be sold only where the electrical energy is generated from water power and there is a surplus of such energy available.

Restaurant equipment—Each manufacturer of the following appliances to restrict his output to the number of styles and sizes specified:

	No. of styles	Total No. of sizes
Bake ovens	1	5
Broilers	2	3
[illegible]	2	3
Toasters	2	2
Hotel ranges	1	2

In the appliances not discontinued, the Conservation Division has cut out 691 different styles and sizes. For instance in chafing dishes, there were thirty-six styles and but three will be allowed; of electric teapots, twenty styles and one allowed; of toasters, ten styles and but two allowed. Manufacturers are to discontinue silver plated and copper finish appliances from the styles and sizes they will continue to make.

None to Add to Style.

In no case is any manufacturer to add to the number of styles and sizes that he is now making.

Each manufacturer of the following appliances to restrict his output to the number of styles and sizes specified:

	No. of styles	Total No. of sizes
Chafing dishes	3	1
Percolators with faucets	3	2
Percolators without faucets	3	2
Samovars	1	1
Nursery water heaters	1	2
Teapots	1	1
Hot-water kettles	1	1
Ovens	1	1
Reflector heaters	2	2
Toasters	2	1
Toaster stoves	1	1
Convector heaters	1	1
Disk stoves	2	2
Fireless Cookers	1	2
Flatirons, 7½ lb. or less	2	2
Grills	2	1
Heating pads	2	2
Hair dryers	2	*1

*1 in each style.

Ranges: No more than six different ranges covering both styles and sizes to be made at any one factory, and none to be made at any factory that is not producing ranges at this date. Nickel plating and fancy ornamentation to be eliminated.

Electric Company Could Not Collect

Mr. Justice Demers, in the Superior Court, Montreal, has dismissed two claims of the Vaudreuil Electric Co. Ltd. for $23,456.40 and $10,046.55 against Curtiss and Harvey (Canada), Limited, in liquidation. The Vaudreuil Electric Company had contracts for these amounts with the Curtiss & Harvey powder plant, at Dragon, prior to the explosion of last summer, which destroyed the plant completely. Following the disaster, the company filed claims with the liquidator of the Curtiss & Harvey Company for the above sums. The liquidator opposed the claims on the ground that the disaster was of force majeure, and that the firm in liquidation was not liable. This contention was upheld by the court, which declared that the accident could not be attributed to any fault of the Curtiss & Harvey Company.

Mr. R. F. Irvin has been appointed assistant to L. D. Calhoun, the advertising manager of the Square D Company of Detroit, manufacturers of Square D Switches. The appointment became effective October 3rd. Mr. Irvin was formerly branch advertising manager of the B. F. Goodrich Rubber Co., in charge of advertising for the Philadelphia territory.

What the Coming Victory Loan Means to Every Class in Canada

By Mr. E. R. Wood

One year has elapsed since we prepared to subscribe the first Victory Loan (our fourth loan) issued in November, 1917. We then realized clearly, and for the first time, that Great Britain had reached the point at which she was compelled to borrow funds in the countries in which she is making her war purchases. This was, and is, an extremely important consideration for Canada, because our activities, prosperity and assistance in the war, depend almost entirely on our ability to market our factory and farm products in the United Kingdom.

When we were asked to subscribe to the Victory Loan, we were enjoying what we may term the prosperity of war, due to the vast volume of orders placed in Canada by the United Kingdom. These war orders were, and are, the backbone of our general position.

We were faced also with certain results of the entry of the United States into the war. The most serious was the closing of that money market to our financial requirements. During 1915 and 1916 Canada was able to subscribe the greater part of its war loans, leaving a portion of them for subscription in the United States which also financed a large part of our ordinary requirements. The new situation created the necessity not only of making Canada's 1917 Victory Loan an unqualified success, but also of financing the Provincial Governments, municipal and corporation requirements, in addition to taking up maturing obligations in the United States. Those obligations in ordinary times, would have been renewed in that country.

With the subscription of a large Victory Loan in prospect, and these serious financial factors governing the situation, the market for bonds other than war issues was at a complete standstill, and the outlook was not good.

The trend in the financial position in the United States during the past 3½ years so far as Canadian borrowings are concerned, is shown in the following table:—

1915	$110,508,000	$64,094,000	58
1916	80,014,000	57,610,000	72
1917	32,404,000	8,425,000	26
1918	61,005,000	1,700,000	2.78

When the United States entered the war, in April, 1917, we were therefore faced with two important factors, namely, that Great Britain could not pay cash for her purchases in this country and that the United States could not longer help to finance Canada.

That was the delicate and dangerous situation. The success of the Victory Loan met that situation completely.

Cause of Great Business Activity

The great business activity resulting from the issues, created additional funds for investment. In due course, it afforded sufficient surplus funds in our own country to finance, not only the requirements of war, but also credits for the United Kingdom and loans to our provincial governments and municipalities. During the first eight months of 1918, Canadian investors having taken the large Victory Loan of last fall, have also been able to finance our province and municipalities to the extent of $60,000,000, as mentioned above. In addition $50,000,000 of the 1917 Victory Bonds have changed ownership, being bought by bona fide investors from holders who found it necessary or desirable to lessen their holdings. This wide and continued interest in the Victory Bonds is no doubt due to some extent to the fact that the Canadian people have been educated by the Victory Loan campaign to invest their savings in Dominion Government Bonds.

It ought to be clearly understood that in approaching our next Victory Loan, we are faced with an equally serious situation. Only by the complete success of our 1918 Victory Loan can we continue to finance our requirements and carry on generally in the way we have during the past seven months.

Gave New Lease of Life to Dominion

The remarkable over-subscription of the 1917 Victory Loan completely changed the uncertain outlook which prevailed when the Loan was offered to the public. It gave a new impetus to agriculture, commerce and prosperity. It invigorated our efforts in the war. It allowed, as already stated, our Provincial Governments, municipal and other borrowers to finance their requirements at home. In short, it gave another lease of life to the activities of the Dominion.

A Boon to Canadian Farmers

For the farmer, the Loan was able to finance the only purchaser who could buy his excess products, namely, Great Britain. In the fiscal year 1915, our farmers exported animal produce and agricultural products valued at $209,000,000. For the fiscal year ended 31st March, 1918, they exported no less than $740,000,000 worth of their output, the largest agricultural exports from this country on record.

Manufacturer Prospered by It

For the manufacturer the Victory Loan continued to give the best export market he had ever possessed. Canadian manufacturers during the fiscal year ended 31st March, 1915, exported $85,000,000 worth of merchandise. That period included nearly eight months of war. For the twelve months ended March, 1918, they have exported over $636,000,000 worth of merchandise, an increase in three years of $551,000,000, or 648 per cent. It is interesting to note in connection with these exports that since the Loan was raised, approximately $20,000,000 per month have been advanced to the Imperial Munitions Board at Ottawa for the purchase of Great Britain in this country. There have also been expended approximately $20,000,000 a month for other war purposes in Canada, including large purchases of farm products. This is a monthly total of $40,000,000 or, during the seven months from December, 1917, to June, 1918, a sum of $280,000,000.

950 War Contracts

While the entire farming community has shared in the war orders, all the manufacturers, naturally enough, have not been benefitted directly. Even so, contracts have been given to 950 manufacturers, and in July, 1918, 400 manufacturers were in actual contract relations with the Imperial Munitions Board at Ottawa.

Up to June, 1918, our manufacturers have produced over 60,000,000 shells, 20,000,000 fuses, 74,000,000 lbs. of powder and 50,000,000 lbs. of high explosives.

Of the 1,654,000 tons of steel used in our war work, 1,400,000 tons were produced in Canada.

Contracts have been let in Canadian shipyards for 90 steamships with an aggregate dead weight tonnage of 455,000 tons. These orders have a value of $71,000,000.

National war plants have been established at a cost of

$15,000,000 in Montreal, Renfrew, Trenton, Toronto and Parry Sound, where powder and high explosives are made, fuses loaded and forgings produced and aeroplanes built. These plants have been given their contracts by the Board at the same prices and on similar terms as the independent makers of munitions and they have already amortized their cost to the extent of $10,000,000.

Large quantities of fir and spruce are being purchased by the Imperial Munitions Board in British Columbia for aeroplanes. The Board now has 67 logging camps in operation.

Made Possible Big U. S. Orders

As a collateral advantage to Canada, by reason of the development of capacity to manufacture in a large way, the United States have found it to their advantage to place orders for the production of munitions in Canada to an important extent; the United States supplies all the raw materials, Canada supplying the labor and experience. The benefit of this to the United States, as well as to Canada, will be understood from the fact that the 75 millimetre shell, which is the size for which the largest number of orders have been placed, both in the United States and Canada, were produced in Canada last month in a quantity in excess of the total production in the United States. The production of this size of shell in Canada now on account of the United States Government is 255,000 per week and is steadily increasing.

As a further evidence of the interest of the United States in the developed capacity of Canada, representatives of the marine section of the Imperial Munitions Board were asked to attend a conference called by the Emergency Fleet Corporation of the United States in Philadelphia on the 21st of June, for the purpose of ascertaining what assistance Canada could give to them in the production of marine engines and marine supplies. Already large orders have been placed in Canada for marine castings and winches, and general supplies for the shipbuilding program in the United States. Of course, it is obvious that this business from the United States will have a marked effect upon the exchange situation, as the money is practically all for wages, as the material is practically all from the United States.

Labor Demand Maintained

The success of the Victory Loan insured a continued demand for all kinds of skilled and unskilled labor. High wages have been received and have helped to cope with the increased cost of living resulting from the effects of war for a long period. Agricultural, factory and other labor have earned good wages, giving a margin for saving.

The placing of $400,000,000 by the subscribers to the Victory Loan, in the hands of the Government, enabled the authorities to continue to finance the basis of our prosperity, namely, war orders from the United Kingdom. It assisted them also, to a marked degree, in seeing that Canada does its full part to support our troops at the front, to help feed the Allies, and to bring the war to a successful conclusion as speedily as possible.

The flotation of the Victory Loan, in short, has kept in motion and in good running order the complex, economic machinery of the country.

New Loan Must Be Over-subscribed

Now with regard to Canada's 1918 Victory Loan, it is imperative that it should be well over-subscribed and even more successful than the 1917 Loan.

This is necessary, firstly, because we cannot continue to do our part in the war without the required funds; secondly, because we cannot obtain those funds unless the national activities are maintained at high pressure; and thirdly, because that end cannot be accomplished unless we finance the national activities which have such a vital bearing on the international situation and the conclusion of the war.

It would be a disastrous error were we to be lulled, because of our prosperity, into a misunderstanding of the real situation. It cannot be emphasized too frequently that the safety of our national structure and our participation in the war, depend entirely upon the results of the 1918 Victory Loan.

Our Prosperity Depends on It

Our prosperity during the past year was a direct result of the response to the loan issued last fall. The continuance of our prosperity during the coming year will depend upon the degree of success achieved by the Victory Loan of 1918. Unless we do even better than a year ago, we will jeopardize the prevailing prosperous conditions and activities which, in turn, allow us to participate freely in the conduct of the war.

There is not a legitimate reason why on this occasion we cannot better the results of the previous Loan. We have done well in the past, both in the aggregate and per capita. At the same time, we realize that our position in Canada is a fortunate one, compared with that in European countries which are in the immediate zone of war. No one can reasonably contend that we have yet achieved the best possible results in regard to the raising of War Loans. The evidence of better latent efforts are apparent on every hand. It remains only to organize and give effect to them. For example, while the total bank deposits in Canada on the 30th of November, 1917, were $1,547,000,000, they had decreased to only $1,541,083,788 on 31st July, 1918, a comparatively trifling decline of under $6,000,000, while the deposits in Canada at 31st July, 1918, are $160,000,000, greater than 31st July, 1917. This excellent record was achieved despite the subscription of the 1917 Victory Loan of $416,000,000, despite the absorption of $50,000,000, of those bonds sold by holders during this year, who desired to realize, and despite the purchase by our investors of $60,000,000, provincial and municipal bonds. These are substantial indications of Canada's ability to subscribe another large Victory Loan, because the national activities allowing the nation to make such a record as outlined above, have continued in a marked degree, making it possible to repeat and better the 1917 Victory Loan and general record of the country.

We Must Finance British Purchases

Great Britain having borne a tremendous burden of war for four years cannot be expected to finance her war purchases in this country. The United States is perfecting a vast war machine. Her financial resources are required for that purpose and to place credits at the disposal of the Allies. It is necessary, therefore, that Canada should raise the funds required, not only to carry on our normal and war activities, but also to advance substantial sums to Great Britain for her purchases here.

While in the United States, the people have been asked to subscribe a Liberty Loan every few months, we, in Canada, have not been asked to subscribe a war loan since November, 1917, This is an enormous advantage in every way. The long respite from War Loan activities, has enabled the 1917 Victory Loan to be splendidly absorbed and distributed. Has in addition created a healthy market for provincial and municipal bonds, and has allowed business generally to proceed without the temporary halt which war loan issues always bring. Furthermore, it is not too much to say that the maintenance of the market price of the 1917 Victory Loan at the issue price and the recent advance in the issue price constitute a record in war finance.

If satisfactory results are achieved with Canada's 1918 Victory Loan, the funds raised thereby will supply our needs for another year. That is an additional reason why every effort should be made to make the Loan an unqualified success.

The Electrical Dealer from a Manufacturing Standpoint

By Mr. Samuel A. Chase*

In these days of reconstruction along almost all directions of human effort, it is not strange that a spirit of unrest should have found an entrance to the field occupied by the jobbers and contractor-dealers. Lawyers of the highest eminence are persuaded that both the practice of law as well as the law itself are facing changes of a radical sort. A diploma, a small black bag and a sympathetic, bedside manner no longer constitute the essentials of a profitable medical career. Merely to know that c-a-t spells cat does not necessarily qualify one to teach the fact to others. And precisely as law, medicine and pedagogy have a future entirely different from the recent past, so also is it most reasonable to believe that the same principle applies with equal force to the more complicated business of selling the product of a factory.

Change is the fundamental fact of economic progress. To recognize and accept the probability of a change is one-half of the problem; and to see its direction accurately provides the ultimate solution.

The inexperienced manufacturer of electrical appliances creates a sales policy of selling direct, forgetting the jobber, and contractor-dealer, and says they are useless. Cut them out; they are carbuncles on the commercial body; they are parasites; "they toil not neither do they spin." Many of you have heard this sort of statement. It pretends to be an argument, and poses as a demonstration. Being both loud and misleading it is the song of the siren in every sense so far as any useful purpose can be found. Nevertheless it has tempted many a manufacturer from the ship of safety and one glorious summer of success has induced a multitude of disastrous financial winters.

Nearly every commercial line has been attacked by the fever, with the usual losses to the manufacturer, and the injury of the distributor and seldom to the advantage of the manufacturer.

There is an old saying that "the longest way 'round is the shortest way home." Experimental short cuts often are costly. A multitude of greedy manufacturers have tried to sell direct at the jobber's price; a myriad of grasping retailers have tried to buy directly from the manufacturer, with the jobber's discount. So they lock horns over this trifling middle percentage and upset the stability of trade conditions very greatly to their own loss.

I am familiar with some of your problems; not all, not nearly all. But I know the confusion caused by the electric light companies when they sell electrical merchandising appliances at cost in order to increase the consumption of current. I know about the pit dug by the local contractor—into which he himself frequently falls. But although I know something of your "'hard trials and great tribulations," I know also that you should occupy an impregnable stronghold.

In the first place "possession is nine points of the law." You may say confidently with Napoleon "I am here. I shall stay."

Secondly, "in union there is strength," and you will impress others through consolidating associations, as an united body.

Any plan of reconstructing the method of selling electrical merchandising appliances through the co-operation and close alliance between the manufacturer, jobber, central station and contractor-dealer, distributing through natural and legitimate channels, will place the electrical industry in a better relation to the trade than ever before.

It will make close friends of those who have sometimes been active enemies. This would be no small accomplishment if there were nothing else; but it is only the first of a long list of benefits which will accrue, not only to the manufacturer, but also to everyone interested in the electrical industry. Why? Because the policy will give balance and stability to the commercial phase of the business. It will establish a relation which is an improvement on "live and let live" since it is based on the idea of co-operation—"live and help live."

Wrong Methods in the Past.

For several years, as you know, the condition of the electrical trade in some respects has been going from bad to worse. Not that we, as manufacturers, have not made money, or that the contractor-dealers as a class have been doing business at a loss. But any business which proceeds along other than sensible roads is conducted wrongly in that particular direction in which it diverges from the path of efficiency.

We know that you live under a competition so severe that only the most robust and aggressive contractor-dealer can survive. We know that the dealer is as necessary a part of the electrical trade as the manufacturer or the jobber in the sale of electrical merchandising appliances. And, with this knowledge set clearly before us, we propose to do our utmost to assist toward reconstructing the highway of business.

Where there is a rut, we'll get out of it; where there's a steep grade, we'll go around the mountain; where there's a chasm we'll bridge it; and where there's a long detour, we'll build a short cut.

In the grand orchestra of electrical business, the smallest retailer should find a place in which to play his piping piccolo and the manufacturer and jobber should co-operate.

But, gentlemen, there is one important number of an orchestra we must not forget; that is the leader. So why not assume the leadership of all the contractors of the United States united in one body?

If it is desirable, it may be feasible. If it may be feasible, it may be done. But it will not be done by merely talking about it, or wishing for it. There must be preparation; the music must be written; the instruments tuned and the performers trained. There must be team-work in the best sense. There must be mutual confidence, as well as individual courage. Utilize these qualities; combine them in the way that you can and you need have no fear for the result.

On the other hand, there is no folly greater than to fool oneself; and it is folly to assume that the distributor has a vested right to any business. He must make his claim good by performance and he cannot perform successfully without a clear knowledge of his powers and limitations.

The manufacturers and jobbers must get the dealer's lively sympathy and then his active co-operation and he must assist to create a demand for electrical merchandising appliances and do all the things which are vital and necessary to merit the business.

One of the principal criticisms of the manufacturer in

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the past has been that the average contractor-dealer does very little to create a demand for the sale of household and other electrical appliances to the consumer. In other words, he is not a merchant.

If the contractor-dealer will become a real merchant, there is no department of selling in which the manufacturer and jobber will not be ready and anxious to help him. Suitable advertising matter will be furnished; salesmen instructed and attractive window displays suggested and the manufacturer, jobber, central station and contractor-dealer will go hand in hand down the road of business prosperity.

I believe it pertinent at this time to emphasize that the manufacturers believe that the electrical dealers have not been as active as they should be in the sale of motor-driven devices, and there is a great possibility in this field.

Take for instance, six of the commonest electrically-operated machines used in the home, i.e., the washing machine, the sewing machine, the ironer, the vacuum cleaner, the fan-motor and the polishing and grinding motor. All

BUY VICTORY BONDS
Are you SUBSCRIBING the way they are FIGHTING?

of these classes of apparatus have been developed to a high degree, are manufactured in very large quantities and should be universally used wherever electricity is available.

The fact that the electrical dealers have overlooked this possibility is noticeable since a number of new concerns have sprung up who do nothing but handle devices of this kind, adding to their line a full line of heating apparatus. Such dealers can now be found doing a profitable business. Their stock in trade consists of an attractive display room in a district frequented by women on their shopping tours, usually some advertising and in some instances, solicitation through the residential district.

The electrical dealer has been slow to get into this particular field and, I believe that in order to handle devices of this kind, he must have an attractive store, he must be in a position to do extensive solicitation, considerable newspaper advertising and render services from time to time in connection with such devices as he has sold.

It is true that either an attractive display room or else a system of house to house canvassing with samples furnished free of charge is necessary. Newspaper advertising has also been effective, if the advertisements are properly timed and carefully prepared. The question of service is furthermore necessary, but the successful electrical dealers make their service feature one for building up additional business. In other words, their service men who go out to repair or adjust any device sold, open up sales for other classes of apparatus. They distribute literature and report prospects to the office, which are followed up systematically and energetically.

A good illustration of this service feature is that pursued by a concern out west which has recently put on the market a farm lighting outfit. The sales organization of this company feels that they are just starting when they sell the farm lighting outfit. They follow up the prospects with all sorts of electric devices, such as fans, house pumps, washing machines, ironers, sewing machine motors and small motors for general power purposes. Their prospect becomes a regular customer for lamps. He, undoubtedly will make extensions in time in his wiring and will require supplies. Thus, they become the sole supplier of the farmer's needs along electrical lines. If more of the electrical dealers would pursue such a policy as this they would, undoubtedly, build this business up enormously.

It would pay the electrical dealers to get in touch with the manufacturers of small motors and electrically operated devices used in the home. On the most expensive of these, extension time payment plans are now worked out which enable the householder to finance purchases which he could not think of financing if he were required to raise the necessary cash.

This is the time of great economy. There are many tens of thousands of electrically driven washing machines being sold each year and this number is increasing in spite of the increased cost of living, due solely to the fact that they are reliable labor savers. Many women are dispensing with their laundress and either handling the washing machines themselves, or doing so through the maid of all work they usually employ. This means a direct weekly saving which will pay for an electrically-driven washing machine and ironing outfit, before many weeks pass by.

Likewise, in the sewing machine motor, there never was a larger demand than there is at the present time in connection with a large amount of clothes that are being manufactured and the enormous amount of Red Cross work which is being done. These same arguments apply to the other devices I have named, and there is no question in our minds but what the next two or three years are going to show an increasing demand for labor saving devices.

The electrical dealer has not been alive to this situation in many localities. Manufacturers have had to establish their own branches for retailing these electrically-driven devices and as indicated, a special class of labor has sprung up simply because the electrical dealer has not realized the opportunity and modified his business methods to meet this new condition.

Electrical manufacturers and manufacturers of motor-driven machines used in the household have worked out quite extensive selling campaigns, based on experience gathered in the field, which is all furnished to the electrical dealer gratis, as well as other literature and sales helps.

Exclusive of manufacturing, all business is divided into three principal parts—buying, selling and paying for something. If therefore your president was authorized to appoint a trade promotion committee, I believe excellent results could be obtained, this committee to be composed of four members or more; a distinguished buyer, a mature, widely popular salesman; a financial man of ripe experience and an experienced advertising man. They would be important men in the trade, no two of them connected with the same house, and the president, ex-officio would be a member of the committee.

Your trade promotion committee would have wide authority; no written reports to make, and its meetings would be frequent. It would receive suggestions thankfully from any source, but incur no displeasure for not using them. The cost of its operations would not be difficult to assess equitably, and also would be negligible as compared with the vast benefits, financial and moral, which should accrue.

Through this compact little committee you would find the means to combat successfully any apparent tendency to invade your logical right to an important place in the world's electrical business. You would be able to show greed how it over-reaches itself by injuring you and ignorance would be converted into a knowledge that the electrical contractor-dealer must not, in fact, cannot be ignored.

In short, if there should be a definite tendency on the part of the manufacturers and jobbers to eliminate the contractor-dealer in your particular branch, you occupy a peculiarly strong position which can be strengthened by maintaining the closeness of your union and by a systematic, persistent course of education to instruct those of whom you buy and those to whom you sell, in the invaluable nature of your services.

Service at Cost for Toronto Railway

Mr. Herman H. Pitts, of Ottawa, a director of the Toronto Street Railway, is at the head of an organization to be known as "The Association of Holders of Public Utility Securities." It is hailed by the newspapers as an attempt to ward off the taking over the railway by the city when the franchise expires in 1921. The association has for one of its aims the inauguration of "service-at-cost" or in other words, a sliding scale of fares to increase or decrease proportionately with the changes in the cost of service.

Peterboro Railway Extension

The Peterboro, Ont., street railway will be extended from Charlotte to Patterson street; two more cars added and the service improved generally. After these improvements there will be no more six-for-a-quarter tickets, excepting in special hours. The regular fare will be five cents, or five tickets for a quarter. School children's tickets will remain the same. It is provided that this arrangement shall last for one year after the end of the war.

Use All Steam Plants

At a recent meeting of the Guelph, Ont., board of light and heat commissioners it was decided that arrangements be made immediately with all power users who have steam plants not in use to start them at once and use to the fullest extent. If this does not furnish the required load the commissioners have further decided that all power users who have no war contracts will have to discontinue the use of power. Electric heaters must not be used from 7 a.m. to 6 p.m. excepting at the noon hour, Saturday afternoons, Sundays and holidays. The street railway is also affected by the power shortage, being only able to run in restricted hours.

Trade Publications

C. G. E. Publications—Bulletin 47135A, standard unit alternating current switchboard panels for general use in isolated and small plants, 1150 and 2300 volts; Bulletin 47050A, standard unit direct current small plant switchboard panels for two-wire general power and lighting service; Pamphlet No. 622, electric heaters for the home, office and factory; two leaflets, describing "Holophane" reflectors and fittings and "Holophane" Realites and special units; Bulletin 40017, small direct-current generators, type ML; Bulletin 46500, C. G. E. indicating flow meter, type FS-2 for steam, FW-2 for water and FA-2 for air; Leaflet 68413, CR 2940 push button stations.

Electrical Blue Book—8th edition, 1918; International Trade Press, Inc., Chicago, publishers; 274 pages, 9 x 12 inches, cloth binding, illustrated, price $2.00. The book is composed of three principal parts. The first comprises some 150 pages of catalog exhibits of approved electrical fittings and appliances as produced by the leading electrical manufacturers; all of these pages are well illustrated. In the second part is given an outline of the Underwriters' Laboratories Inspection Service, with a list of the branch offices and stations and followed by a complete list of inspected appliances and material. The third part consists of the complete National Electrical Code, 1918 edition—the first appearance of this latest code with all the revisions indicated. There is also printed a list of the members of the Electrical Supply Jobbers' Association; a general directory of electrical associations and a complete buyers' guide of electrical apparatus and material.

Electric Iron, Limited, Orillia, Ont., have been granted a Dominion charter.

Current Notes

The Nitro-Daylight Lamp Company have moved from 46 Queen Street East, Toronto, to 12 Queen Street East.

A by-law authorizing an expenditure of $10,000 to bring Hydro power into the township of Markham, as far as Unionville, has passed its third reading in the township council.

The British Columbia Electric Railway Company have announced that all returned soldiers minus an arm or leg are entitled to free transportation on any of their city lines.

The Swedish General Electric Company have moved from 11 Dundas street to larger quarters at 109 Duke street, formerly occupied by the Lancashire Dynamo and Motor Company.

The Arcwell Corporation of Canada, Limited, has been granted letters patent and will carry on a general electrical business. The capital stock is given as $1,000,000 and the head office, Toronto.

The Canadian Import Sales Company have opened offices in the Foy Building, 34 Front Street West, under the management of Mr. C. R. Connors. They carry a complete line of flashlight cases and bulbs as well as various other lines of electrical specialties.

Electrics, Limited, have opened offices at 22 St. John street, Montreal. The Company have secured a federal charter, and have elected the following officers: Mr. Stephen H. Wiggett, president; Mr. Andrew C. Hersey, vice-president, and Mr. G. H. Rainville, managing director. The firm are wholesale distributors for Westinghouse "Mazda" lamps, and also for motors, generators and other electrical equipment manufactured by the Westinghouse Company. Both Mr. Hersey and Mr. Rainville are returned officers, who have served overseas for three years each.

Personal

Mr. H. E. Randall has resigned his position as purchasing agent of the Shawinigan Water and Power Co., to take up an appointment with the Ludlum Electric Furnace Corporation, New York. Unfortunately he was taken ill with influenza when about to leave Montreal and had to be removed to a hospital.

Obituary

Mr. Michael Mackay, a well-known telegrapher and formerly manager of the C.P.R. system at Quebec City, died in Montreal recently.

Mr. Frederick G. Wurster, one of Galt's most prominent business men and manager of the local office of the Bell Telephone Company, died recently.

Mr. Ross Bodell, commercial supervisor of the G.N.W. Telegraph Company, Toronto, died a few days ago, a victim of influenza.

Private W. C. Gardner, former traffic chief of the Eastern division of the Bell Telephone Company, Montreal, died in the Royal Herbert Hospital, Woolwich, England, from pneumonia. He joined a draft of the Canadian army service corps in June last and contracted a chill on the voyage to England.

Mr. Frederick J. Dunn, contract agent of the lighting department of the Westmount Corporation, died in the Royal Victoria Hospital on October 11 from pneumonia, following influenza, aged 50. Prior to his appointment with the Westmount Corporation, Mr. Dunn was employed with the Montreal Light, Heat, and Power Co., going to that concern when the Royal Electric Co. was merged with the Montreal Gas Co.

Am I the Man From Glencoe?

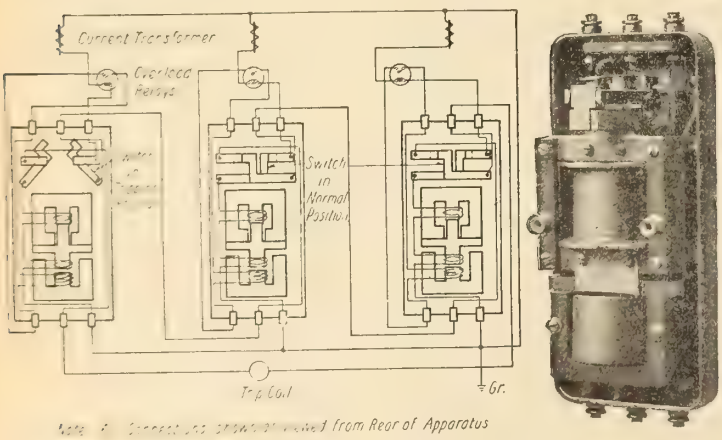
A Glencoe man was asked recently to contribute to one of the war funds, and replied that he "felt he had done enough." A well-known writer in the Chicago Tribune has this to say about the gentleman:

In other words, so far as he is concerned, the war is over and done with. Men whose time is more valuable than the money they give or raise are devoting their entire days to the country's service; but the Glencoe man feels that he has done enough. Women discharge their servants, do their own housework, and labor in Red Cross and other war shops; but the Glencoe man feels that he has done enough. Soldiers, discharged from hospitals in France, feel that they still have something to give, and return to the trenches, but the Glencoe man feels that he has done enough. Mothers, with aching hearts, are sending their sons away to an unknown fate; but the Glencoe man feels that he has done enough. It must be pleasant to be so circumstanced mentally. Few of us are able to forget that the war is still going on.

But passing the hat isn't the best thing we do. We are not diplomatic. We have a healthy and perfectly good-natured contempt for a man who can give and won't give, and we haven't any objection to his knowing it. We don't owe him anything—not even, in these days, politeness.

Transfer Relay

Protective relays that operate by closing a separate direct-current tripping circuit which in turn trips the circuit breaker, have proved more serviceable than "shunt-trip" relays and have come into very general use. In some cases, however, a separate direct-current tripping circuit is not available and other means must be sought. The use of "transfer" relays is the best solution so far obtained, for they energize the trip coil off the circuit-breaker through current transformers. While designed particularly for use with the Westinghouse types CO and CR relays, the type BT relay can be applied to any make of circuit-closing relay of similar characteristics. The breaker operates solely through the current transformer and the relays. When there is no fault on the line, the trip coil of the breaker is mechanically

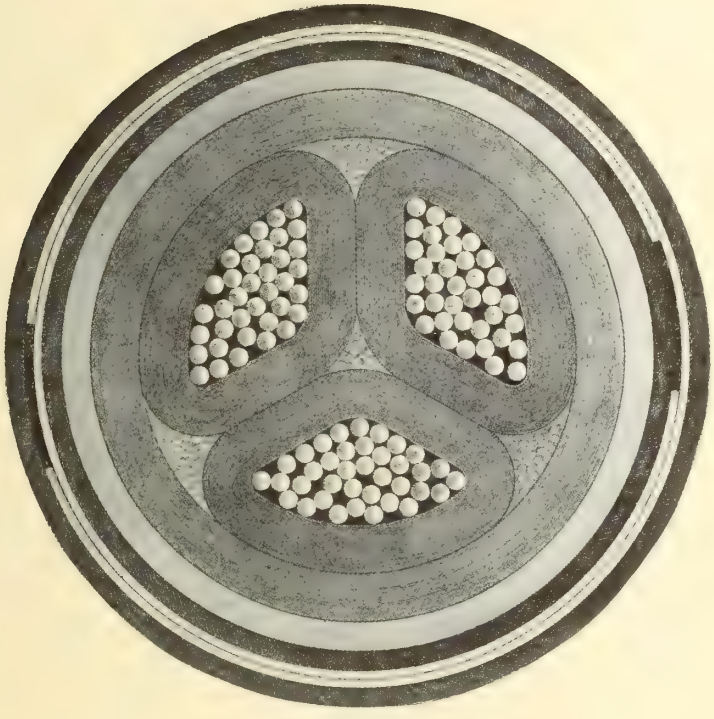


and electrically isolated from the circuit, avoiding possibility of tripping due to imperfection in the relay contacts ordinarily shunting the trip coil. The relay contains two series coils, an upper or operating coil and a lower or holding coil (see diagram of connections). The holding coil holds down the armature core, until a third coil, wound on the same magnetic circuit and known as the releasing coil, is short-circuited by the protective relay. The releasing coil acts as the secondary of a transformer and when short-circuited a current flows through it, demagnetising the core. The holding coil, therefore, allows the operating coil to raise the core which operates the transfer switch, thus closing the trip coil circuit. The transfer switch and other current carrying parts of the relay are designed to carry 5 amperes continuously, but during times of short circuit the switch may be called on to handle as much as 100 or 200 amperes. A current transformer may be selected of sufficient capacity to operate the protective relay, the transfer relay and the trip coil. Low-ratio bushing-type current transformers sometimes used on high-voltage circuit-breakers are not suitable. Only one trip coil is required for use on a polyphase circuit, but if the breaker is equipped with as many trip coils as there are relays, it is advisable to connect each trip coil to its corresponding relay.

Trade and Reconstruction in Germany

In the last issue of the British Board of Trade Journal some account is given of the preparations now being made in Germany to meet the special conditions which will obtain on the cessation of hostilities. It is interesting to note that Economic Boards are to be established. It is not intended to exclude private trade, but to set up these boards and give the industries a form of self-government. It is proposed more particularly that these boards should exercise control over the distribution of the foreign exchange and of tonnage. With regard to the latter, the Tonnage Distribution Office of the German shipping industry will decide questions of a technical nature, and the preference that is to be given to the various goods in shipping. Owing to the probability of the scarcity of tonnage, the German Government has arranged for a subsidy to be paid to the shipping industry in compensation for their war losses, and there are to be stringent regulations so that shipping is retained and is used, firstly, for the transport of absolutely necessary imports, such as food and raw materials; and secondly, for requirements that are purely German and not foreign. The Economic Board for the textile trades will regulate the distribution of certain kinds of wool and fibres to the cotton spinners as substitutes for cotton. In this connection it may be noted that, out of 1,700 spinning and weaving factories in Germany, only 70 large ones are now working; in the silk trade, out of 45,000 looms, only 2,500 are at work; in the oil industry only 15 ont of 720 firms are still active; while in the boot and shoe trade half the firms have closed down. The most important to note, however, is that the German Government is quite alive to the problems that will have to be faced in reconstruction, and in this country we shall do well to see to it that our plans are fully prepared and that the Germans do not make use of our methods before we put them into execution ourselves.—Electrician.

POWER CABLE



350,000 C.M. 3-Conductor 12000 volt
Paper Insulated, Steel Tape Armoured Cable
Overall Diameter—3.62 ins.

Built to Specifications of Hydro-Electric Power Commission of Ontario

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Electrical Books—Special Prices

The following Books are Offered Subject to Previous Sale:

A Handbook on the Steam Engine, by Herman Haeder. Published in 1914 by Crosby, Lockwood & Son. 522 pages, illustrated. Price $3.00.

A Laboratory Manual of Alternating Currents, by John H. Morecroft, E.C. Published in 1912 by Renouf Publishing Company. 248 pages, illustrated. Price $2.00.

Alternating Currents—Examples for Students and Engineers, by Prof. F. E. Austin. Second edition, Vol. I. Published in 1916. 223 pages, illustrated. Price $2.40.

Baudot Printing Telegraph System, by H. W. Pendry. Published in 1913 by Whittaker & Company. 144 pages, illustrated. Price $1.00.

"Central Stations," by Terrell Croft, 1st edition published in 1917, by McGraw-Hill Book Co., Ins. 332 pages, illustrated. Price $2.50.

Direct-Acting Steam Pumps, by Frank F. Nickel. Published in 1915 by McGraw-Hill Book Company. 258 pages, illustrated. Price $3.00.

Direct Current Machinery, Theory and Operation of, by Cyril M. Jansky, B.S., B.A., 1st edition, just published by McGraw-Hill Co., Inc. 285 pages, illustrated. Price $2.50.

Dynamo-Electric Machinery, by Francis B. Crocker, E. M., Ph.D. Published in 1908 by American School of Correspondence. 236 pages, illustrated. Price $1.00.

Electric Arcs, by Clement D. Child, Ph.D. Published in 1913 by D. Van Nostrand Company. 194 pages, illustrated. Price $2.00.

Electric Car Maintenance, by Walter Jackson. Published in 1914 by McGraw-Hill Book Company. 274 pages, illustrated. Price $2.00.

Electric Cooking, Heating and Cleaning, by Maud Lancaster. Published in 1914 by D. Van Nostrand Company. 330 pages, illustrated. Price $1.50.

Electrical Machinery—Principles, Operation and Management, by Terrell Croft. Just published by the McGraw-Hill Book Co. 318 pages, illustrated. Price $2.00.

Electrical Meters, by Cyril M. Jansky, B.S., B.A. Second Edition, just published by McGraw-Hill Book Company. 416 pages, illustrated. Price $3.00.

Electric Railway, by A. Morris Buck, M. E. Published in 1915 by McGraw-Hill Book Company, Inc. 390 pages, illustrated. Price $3.00.

Electric Railway Engineering, by C. Francis Harding, E. E. Second Edition. Published in 1916 by McGraw-Hill Book Company. 416 pages, illustrated. Price $3.00.

"Electric Traction," a treatise on the application of electric power to tramways and railways, by A. T. Dover. Published in 1917 by Whittaker & Co. 661 pages with 518 illustrations and five folding plates. Price $6.00.

Electrical Injuries, by C. A. Lauffer, M.D., published in 1912 by John Wiley & Sons. 77 pages. Price 50 cents.

Electro-Dynamics, by Charles Ashley Carus-Wilson. Published in 1898 by Longmans, Green & Company. 298 pages. Price 50c.

Elementary Principles of Illumination and Artificial Lighting, by Arthur Blok, A.M.I.E.E. Published in 1914 by Scott, Greenwood & Son. 235 pages, illustrated. Price $1.00.

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Engineers' Manual, by Ralph G. Hudson. Just published by John Wiley & Sons. 315 pages, illustrated. Price $2.00.

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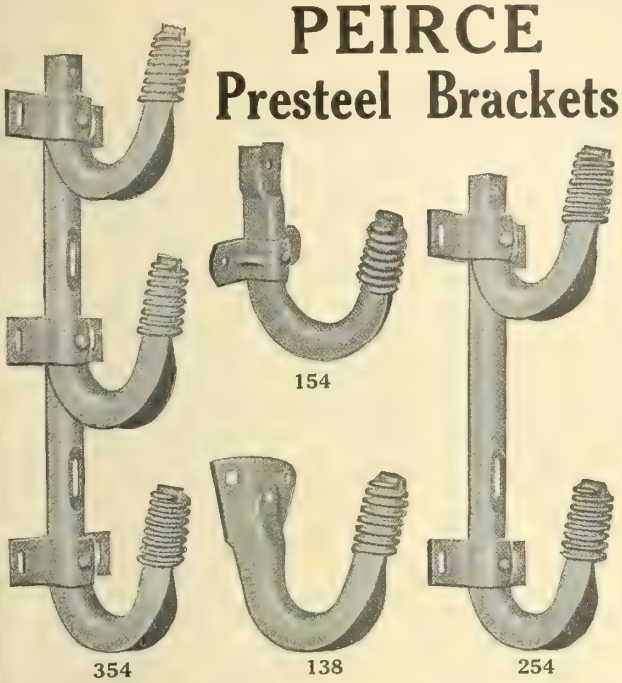
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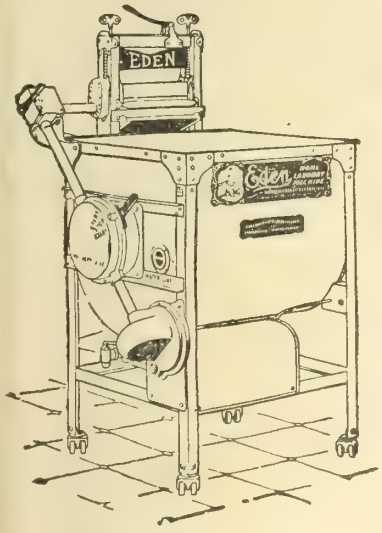


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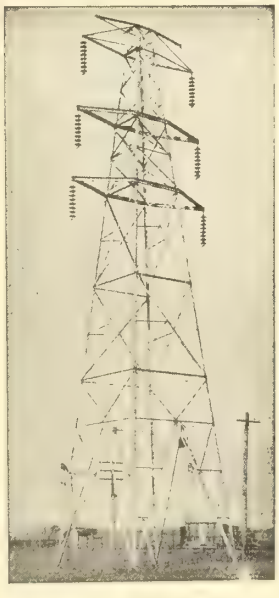
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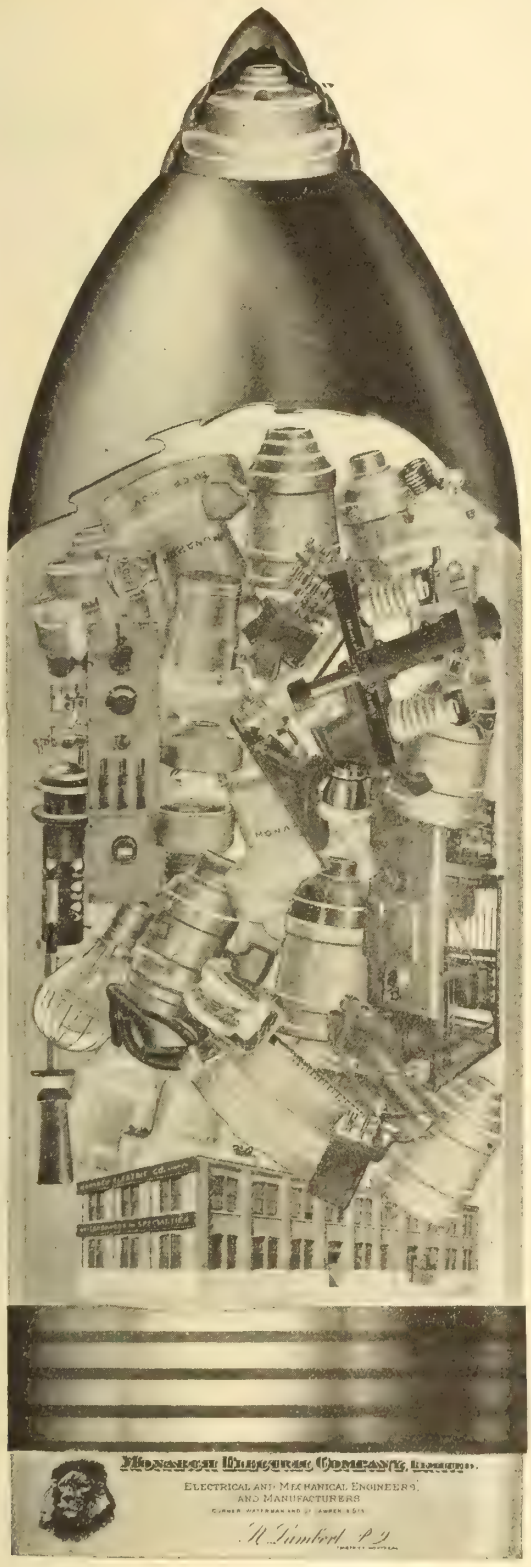
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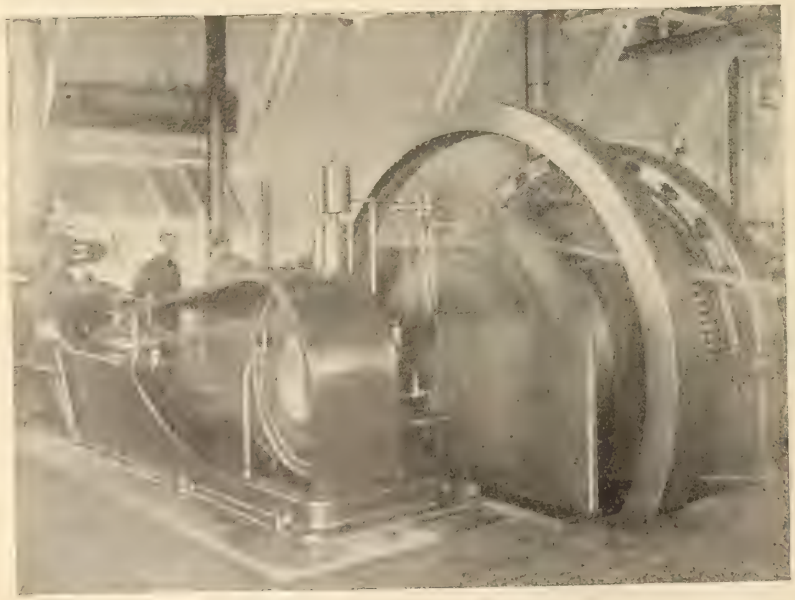
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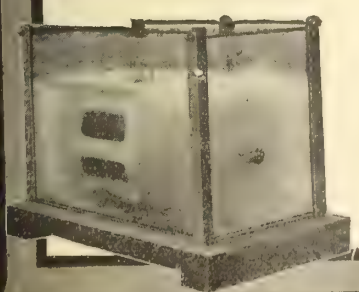
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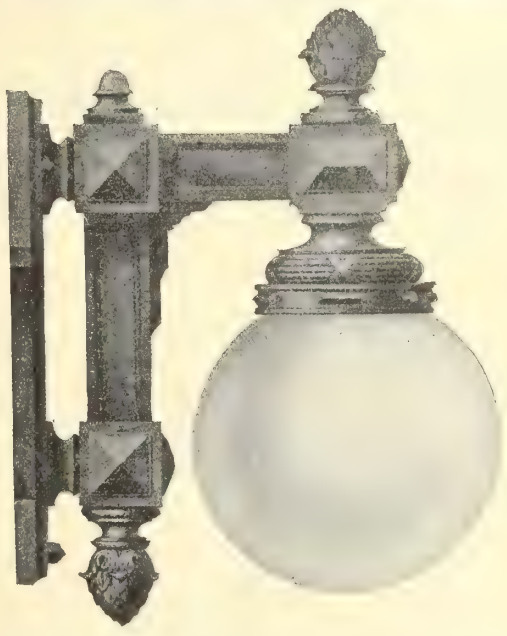
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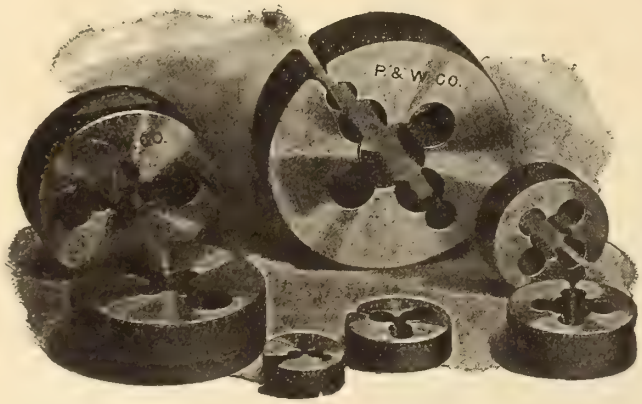
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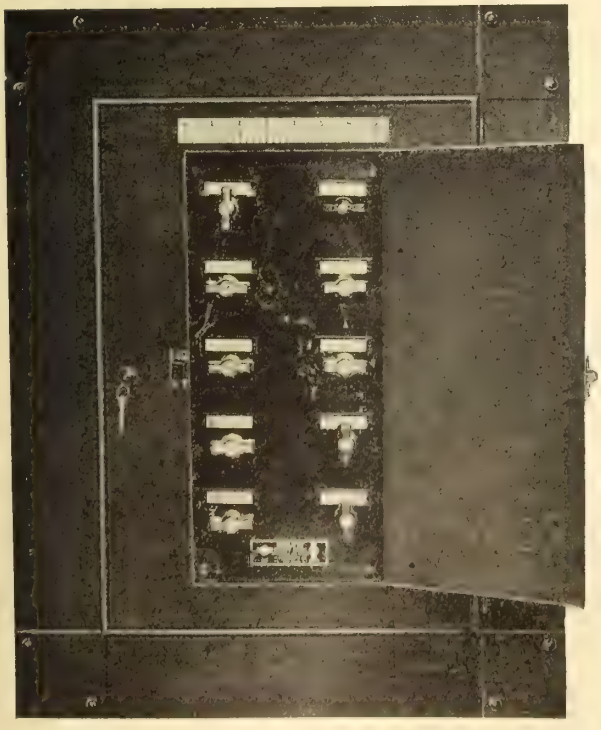
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1	60	3	750	550	25	yes	Crocker Wheeler
2	50	3	750	220	25	yes	Lincoln
1	25	3	750	220	25	yes	Lincoln
1	25	3	750	220	25	yes	C.G.E.
1	10	3	1500	220	25	yes	T.H.E.
1	3	3	1500	220	25	yes	Westg. CCL.
1	½	1	1800	110	60	no	Fort Wayne
1	¼	1	1800	110	60	no	Westgh.
1	¼	1	1800	110	60	no	Fisher
1	40	2	900	220	60	yes	Fuller Wenstrom
1	15	2	1800	220	60	no	T.H.E.
2	5	2 or 3	1800		60	no	Westgh. CCL. rewd.
2	1	2 or 3	1800		60	no	Westgh. CCL. rewd.
1	½	2	1800	220	60	no	Westgh. CCL.
2	10	2 or 3	1200		60	no	Westgh. CCL. rewd.
1	5		1200	220	60	no	Union (New)
2	3	3	1800	220	60	no	C.G.E. rewound
4	7½	3	1800	220	60	yes	Lincoln

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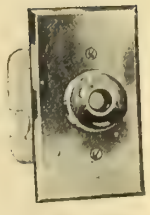

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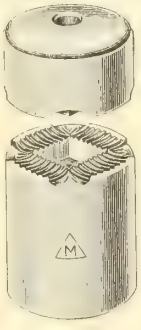
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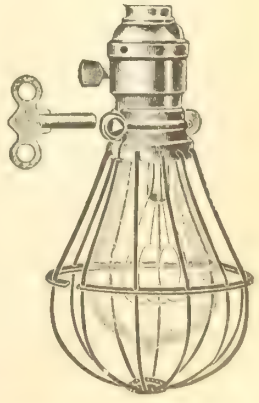
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Canadian Crocker-Wheeler Company
Canadian General Electric Company
Canadian Westinghouse Company
Cumberland Electric Mfg. Company.
Ferranti Electrical Company of Canada
Kuhlman Electric Company
Moloney Electric Company of Canada
Northern Electric Company
Packard Electric Company
Railway & Power Engineering Corporation
Rose & O'Hearn
Thordarson Electric Manufacturing Company
Wagner Electric Mfg. Company of Canada

TRANSMISSION TOWERS
Canadian Bridge Company

TROLLEY GUARDS
Ohio Brass Company

TUBING
Northern Aluminum Company

TURBINES
Boving Company of Canada
Canadian Allis-Chalmers Company
Hamilton Company, Wm.
Smith Company, S. Morgan

UNDERGROUND INSTALLATIONS
Gest, Limited, G. M.
Northern Electric Company
Standard Underground Cable Co. of Canada, Ltd.

VACUUM CLEANERS
Houston & Company
Onward Manufacturing Company
Pringle, R. E. T.

VARNISHES
Spielmann Agencies, Regd.

VIOLET RAY APPARATUS
Branston & Company, Chas. A.

WASHING MACHINES
Onward Manufacturing Company

WATER POWER MACHINERY
Boving Hydraulic & Engineering Company
Hamilton Company, Wm.
Smith Company, S. Morgan

WATER WHEELS
Canadian Allis-Chalmers Company

WELDING EQUIPMENT
Lincoln Electric Company of Canada

WIRE
Boston Insulated Wire & Cable Company, Ltd.
Canada Wire & Cable Company
D. & W. Fuse Company
International Nickel Company
Northern Electric Company
Phillips Electrical Works, Ltd., Eugene F.
Standard Underground Cable Company of Canada, Limited.

WIRING DEVICES
Canadian General Electric Company
Crouse-Hinds Company of Canada, Limited.
Hatheway & Knott, Inc.
Northern Electric Company

CANADIAN PORCELAIN CO.

LIMITED

HAMILTON - CANADA

Manufacturers of High and Low Tension Porcelain Insulators

Do You Install Unprotected Motors?—fuse a small

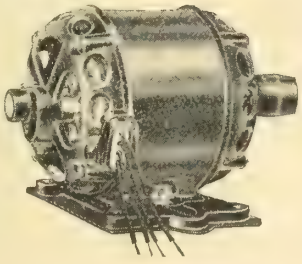
Century

Repulsion Start Induction

SINGLE PHASE MOTOR

(1/10 to 1/4 H.P.)

so as to protect it when carrying full load — and that fuse will usually be of ample capacity to enable it to successfully start full load.



Illustrating a 1/6 H.P. Motor

We Build Other Sizes Up to 40 H.P.

CENTURY ELECTRIC COMPANY

ST. LOUIS, Mo., U.S.A.

Stock carried in Canada by: 262
Jones & Moore Electric Co., Ltd., 294 Adelaide St. W., Toronto
Great West Electric Co., Ltd., Winnipeg
Rudel-Belnap Machinery Co., Ltd., Can. Express Bldg., Montreal
Rankin & Cherrill, 55 Hastings St. W., Vancouver, B.C.

LIGHT INTENSITY

with a minimum of Power

is obtained with the

Pittsburgh Show Window Reflectors



They will increase the light 400 per cent. to 500 per cent. This has been established by scientific test.

Illustration shows "Pittsburgh" Reflector No. 100 for 100 or 150 Watt Lamp. Dimensions: Height, 5½ inches; width, 8 inches; Holder, 2 ins. Form "O"

It will be to your advantage to learn more about the efficiency of these Reflectors. Write to-day for illustrations of the different types of reflectors for show windows and indirect lighting.

Pittsburgh Reflector and Illuminating Co.

PITTSBURGH, PA.

Canadian Distributors

JAMES DEVONSHIRE, Ltd.

701 Yonge Street, Toronto

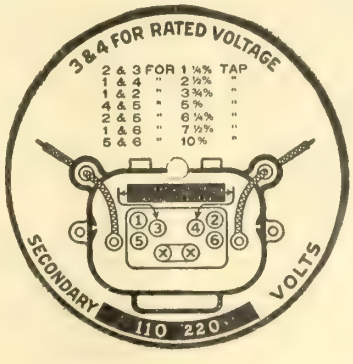
Moloney Pole Type & Station Type Transformers

are all supplied with brass plates fastened on the inside of the cover of each transformer; all connections marked plainly. They do not get covered with dirt or stained with oil like a blue print does. You always have them before you when changing taps. Heavy bushings eliminate breakages in shipment and handling



Station Type

Moloney Transformers are manufactured in a factory that was built especially for that purpose only. They are designed by Engineers and built by men who make a specialty of this work.



Made in Canada



Pole Type

MOLONEY ELECTRIC COMPANY OF CANADA, LIMITED

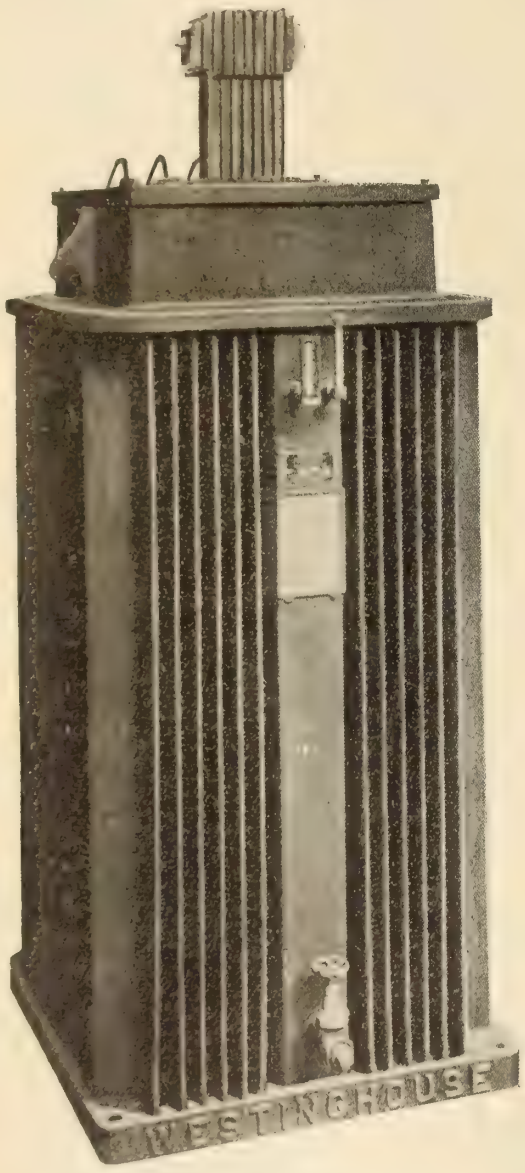
Factory Windsor, Ont.

Head Sales Office Bank of Hamilton Bldg., Toronto

Branch Offices Montreal, Halifax, Winnipeg, Vancouver

Westinghouse

Electric Service Transformers



Westinghouse Oil-Insulated, Self-Cooling Electric Furnace Transformer

All Westinghouse Electric Furnace Transformers are built to withstand the heavy overloads and other unusual requirements, demanded in electric furnace service.

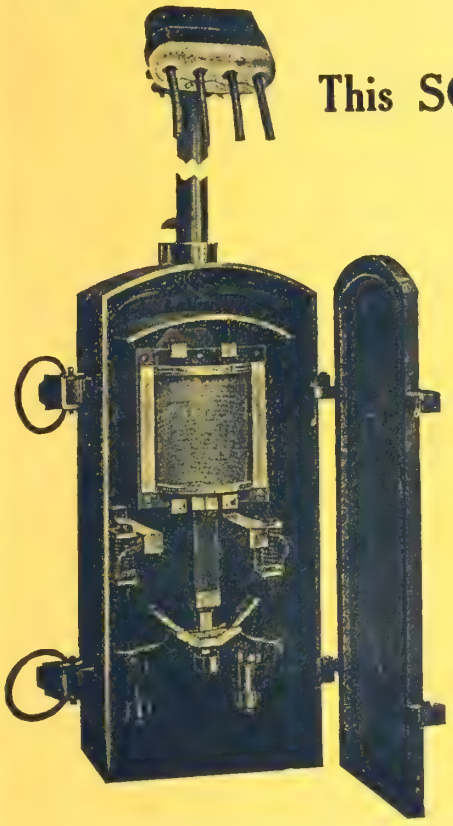
Special attention has been given to the interlacing of the coils, and bracing of the windings.

Oil-insulated transformers are supplied in either self-cooled or water-cooled types, in all capacities and voltages, and for frequencies of 25 to 60 cycles; single, two or three phase.

Leaflet No. 3923 describes Westinghouse Equipment for Electric Furnaces.

Canadian Westinghouse Co., Limited, Hamilton, Ontario

Toronto	Montreal	Ottawa	Halifax	Ft. William	Winnipeg	Edmonton	Calgary	Vancouver
Traders Bank Bldg.	52 Victoria Sq.	Ahearn & Soper Ltd.	105 Hollis St.	Cuthbertson Block	158 Portage Ave. E.	211 McLeod Bldg.	Canada Life Bldg.	Bank of Ottawa Bldg.



This SOLENOID SWITCH has been adopted by the Hydro Electric Commission

They use it for

STREET LIGHTING

Now the fact that it is used by the Hydro-Electric Commission is proof that it is all we claim for it. It certainly is not an experiment, by the fact that it is giving efficient service in many towns throughout Ontario, as well as the other provinces.

No springs, swivels or other complicated mechanisms to give trouble. They close magnetically and are opened by gravity assisted by the tension of the laminated copper contact. All arcing is taken up on the carbons.

Increase the efficiency of your system and decrease the cost of installation by using our Type 17 H.E.P. Solenoid Switches, which are suitable for any frequency on multiple circuit or D.C. Series circuit.

Write for complete descriptive particulars

The Electrical Maintenance & Repairs Company, Limited

Phone Adelaide 902-903

162 Adelaide Street West
TORONTO

Nights Beach 1723-1930

JONES & GLASSCO (REG'D)

ENGINEERS

MONTREAL AND TORONTO

Specialists in

POWER TRANSMISSION CHAINS

CANADIAN AGENTS FOR

"RENOLD"
Patent Silent and Bush Roller Chains

"MORSE"
Rocker Joint Silent Chains

CHAIN DRIVES FROM 1/4 H.P. TO 5000 H.P. IN SUCCESSFUL OPERATION

Write for particulars to

Head Office
ST. NICHOLAS BUILDING
MONTREAL

Branch Office:
1204 TRADERS BANK BUILDING
TORONTO

We have a large stock of

New and Used

Motors and Generators

FRED THOMSON CO., LIMITED

7-13 ST. GENEVIEVE STREET

MONTREAL

We extend a cordial invitation to the electrical fraternity to call upon us in our new building—the largest and best equipped electrical repair establishment in Canada.

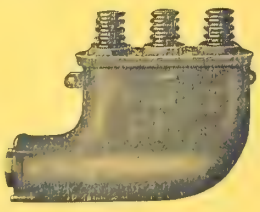
G & W POTHEADS FOR INSIDE USE

Are made in all Sizes, Shapes and Voltages

Five styles of construction in twelve shapes give an almost unlimited range of selection. Any size of cable or conduit can be fitted. Terminals either detachable or non-detachable.



Type "P" Flat Pothead



Type "N" Elbow Pothead



Type "Q" Porcelain Pothead



Type "N" Abutting Pothead



Type "N" Edgewise Pothead

Supplement "B" illustrates various shapes clearly. Mailed upon request.

G & W ELECTRIC SPECIALTY CO.

7440-52 So. Chicago Ave. CHICAGO, U.S.A.

A. H. Winter Joyner, Ltd., 100 Wellington St. W., Toronto.
A. H. Winter Joyner, Ltd., 17 St. John Street, Montreal.
Bentz-Richardson Co., Ltd., 592 Notre Dame Ave., Winnipeg.
General Supplies, Limited, Calgary and Edmonton.

G&W ELECTRIC SPECIALTIES

For the Ends of Cables

G&W ELECTRIC SPECIALTIES

ol. XXVII No. 22 Toronto, November 15, 1918

Electrical News

Generation, Transmission and Application of Electricity



It "Looms" Up !

Northern Electric

DURADUCT

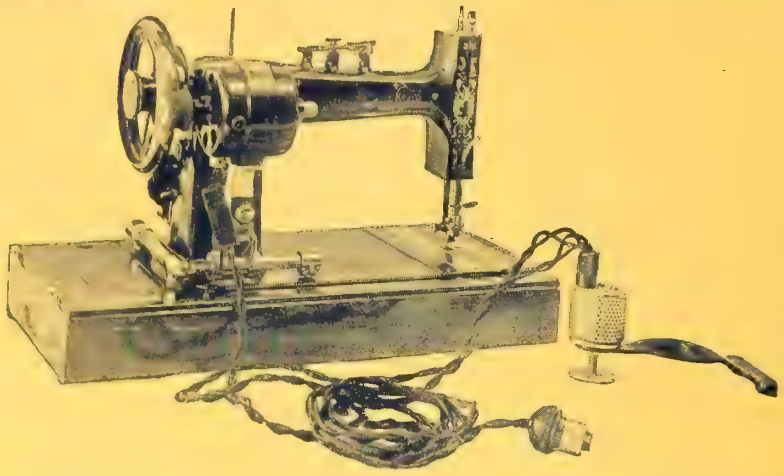
—of course !

—easiest to work with because it is the only conduit with a "roller-bearing" wireway and a single interwoven wall.

Northern Electric Company

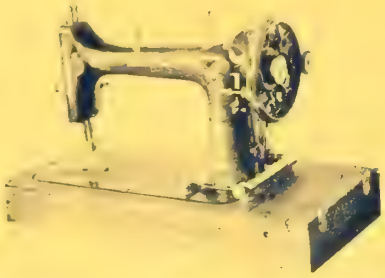
LIMITED

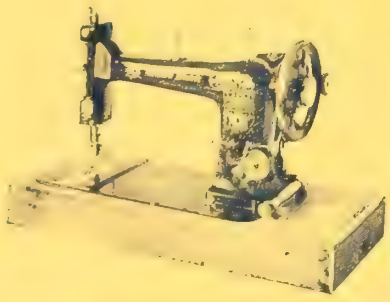
MONTREAL HALIFAX TORONTO LONDON REGINA CALGARY

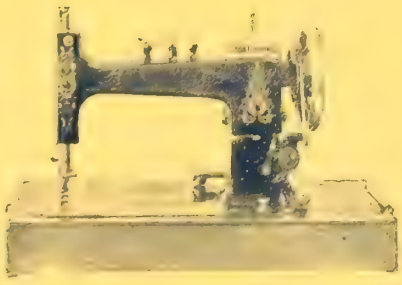


Every Woman Needs Its Help—Now

but when the fall buying season comes, will you be ready?







Why Not Order a Good Supply of

Northern Electric

Portable Sewing Machines NOW?

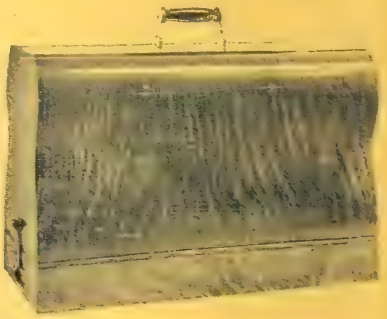
Remember the greatest need for sewing by electricity is now, when the women of Canada are so extensively engaged in doing their own as well as a large amount of patriotic sewing work at home.

The Northern Electric Sewing Machine eliminates the tiresome, back-aching treadle work of the old method, and enables the operator to do twice as much sewing without effort.

The Northern Electric Sewing Machines are of the highest grade in design and workmanship, and carry a guarantee of complete satisfaction in every way.

Several different types are obtainable in both portable and stand style machines. You can secure either vibrating shuttle or bobbin type.

Closed view of our Portable Type Machines

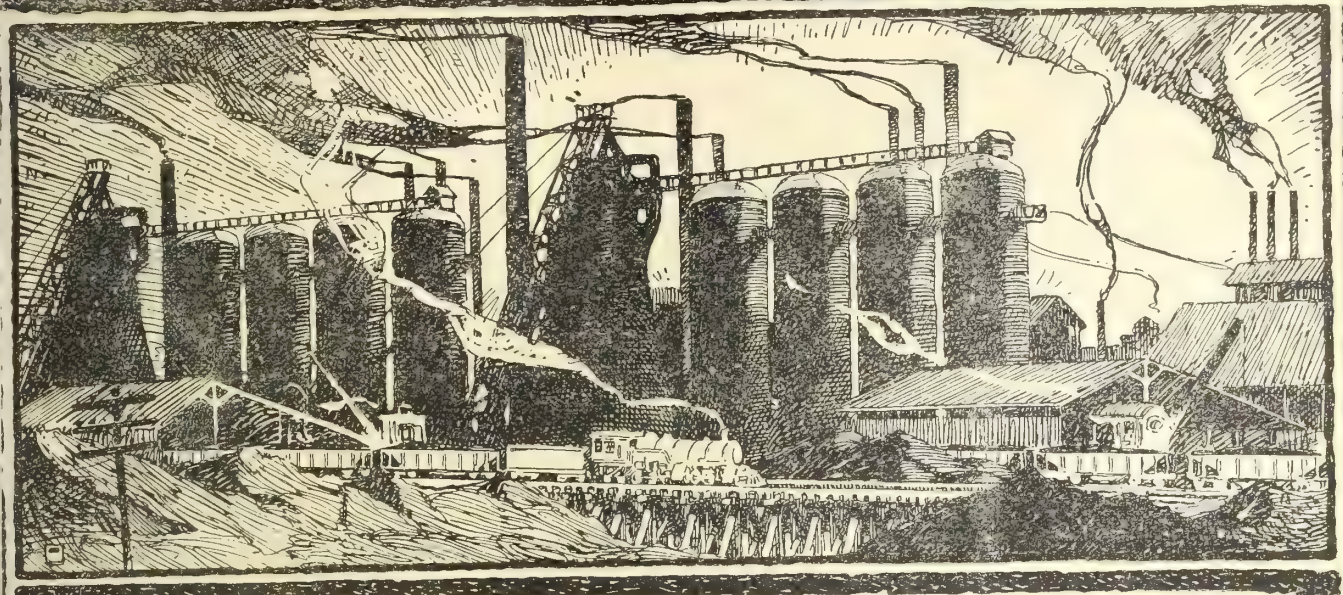


Write our Nearest House for attractive proposition, descriptive literature, etc.

Northern Electric Company

LIMITED

MONTREAL
HALIFAX
OTTAWA
TORONTO
LONDON
WINNIPEG
REGINA
CALGARY
VANCOUVER



LITTLE WORDS WITH BIG MEANING

Quality

According to "Webster," Quality is "an excellence of character; natural superiority."

Service

Webster's definition of "Service" is; "The performance of labor for the benefit of another."

We use these words advisedly—fully understanding their definitions—and realizing the obligation we place upon ourselves by their continued use in connection with our products of Iron and Steel, and our attitude to the people we serve.

THE

STEEL COMPANY

OF

CANADA

LIMITED

MONTREAL HAMILTON

Pig Iron,
Steel & Iron Bars,
Horse Shoes,
Steel and Iron Products.

Steel Billets,
Track Spikes &
Bolts, Forgings, Wire
of every description.

"FLEXTUBE"

FLEXTUBE

The non-metallic, flexible conduit you should buy—for economy's sake and for your wiremen's sake. FLEXTUBE samples and descriptive Bulletin No. 151 sent on request.

National Metal Molding Co.

Manufacturers of

Electrical Conduits & Fittings

1118 Fulton Building, PITTSBURGH, PA.

Atlanta, Boston, Buffalo, Chicago, Buenos Aires, Dallas, Denver, Detroit, Portland, Havana, Los Angeles, New York, Philadelphia, St. Louis, Manila, Salt Lake City, San Francisco, Seattle, Paris

Canadian Distributors

CANADIAN GENERAL ELECTRIC CO., LIMITED

Head Office, - - - TORONTO

District Sales Offices:

Montreal, Halifax, Ottawa, Cobalt, Winnipeg, Calgary, London, Edmonton, Nelson, Vancouver, South Porcupine

Double Compounding  **Double Value**

F8

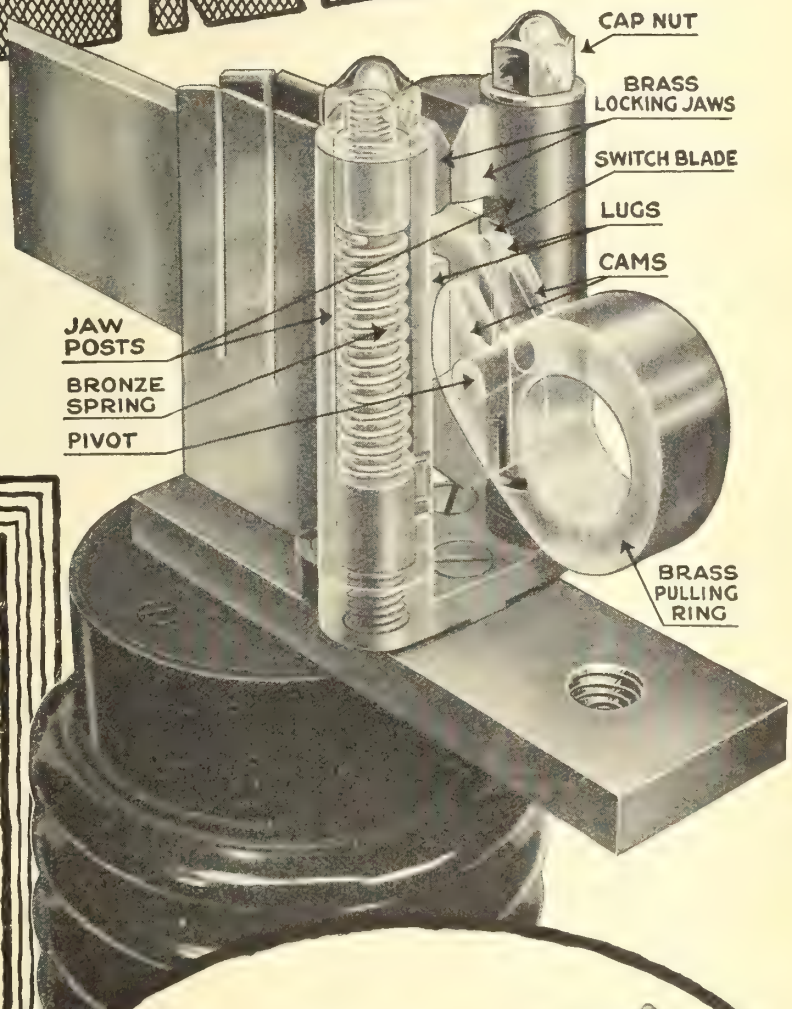
The "FRANKLIN"

Positive Lock

as incorporated in the

FRANKLIN

Disconnecting Switch



THIS phantom view will show you why the "FRANKLIN" Switch Lock is superior in locking effectiveness, in convenience of operation, and in durability to previous devices designed for the same purpose.

The switch-blade is held closed by two rugged brass jaws which form a closed bridge above it. The jaws cannot be forced open by electrical expulsion strains because they open only in a direction OPPOSITE to that of the resultant electrical forces.

The jaw-castings are rugged and rigid. There is no strain whatever upon the springs except momentarily, as the switch-blade passes in or out.

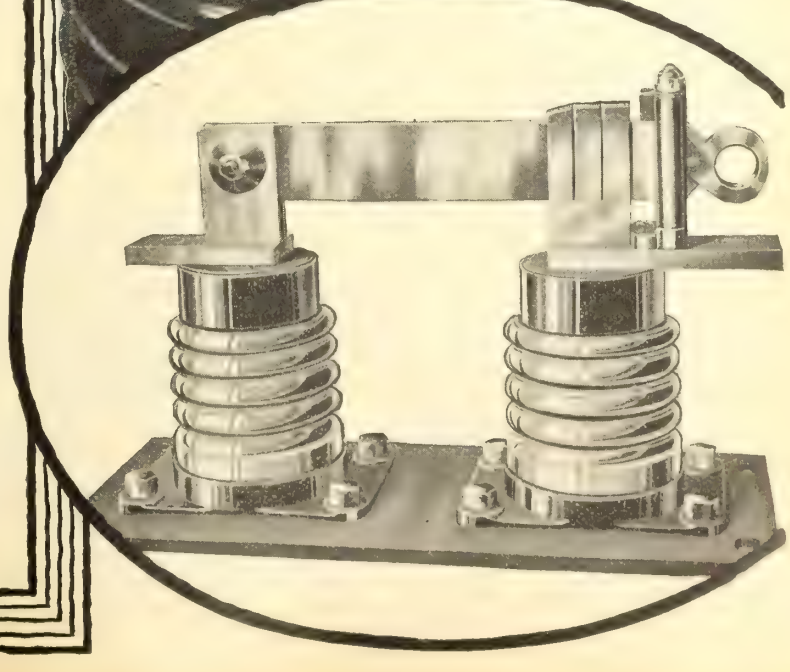
A single pull, with any kind of hook, opens the switch. It causes the cams fixed to the pull-ring to rotate against the lugs projecting from the jaw castings. As the jaws are thus rotated against the springs, the bridge above the blade opens and permits the blade to pass out

The bevelled tops of the jaws permit the blade to pass in easily, so that a single push of a hook will close the switch. When the blade is home, the springs return the jaws with a vigorous, unmistakable snap.

Let us send you Bulletin No. 1250, which describes "FRANKLIN" Disconnecting Switches with "FRANKLIN" Positive Locks. State service and voltage when you write.

SELLING AGENTS

THE PHILADELPHIA ELECTRIC COMPANY SUPPLY DEPT.
132 South Eleventh Street
Philadelphia



Two Smith Turbine Units

Like Accompanying Illustration

Now in successful operation in the Wawaitin Plant of the Northern Canada Power Co., Ltd., Timmins, Ont. Each develops 4,000 h.p., 375 rev., 122 ft. head, and is direct connected to Vertical Shaft Generator, thereby insuring

PRIME MOVERS OF
MAXIMUM EFFICIENCY

No matter what your power requirements are, if it's water power you will do well to submit your problem to our Engineers.

Write Dep't. "N" for Bulletin.



S. Morgan Smith Co.

YORK, PA.

H. B. VAN EVERY, Canadian Representative
405 Power Bldg., MONTREAL

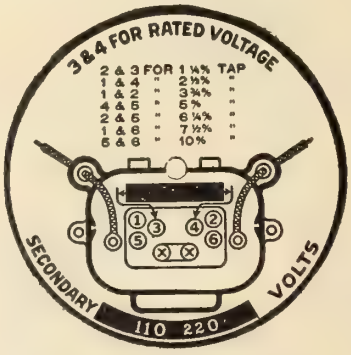
Moloney Pole Type & Station Type Transformers

are all supplied with brass plates fastened on the inside of the cover of each transformer; all connections marked plainly. They do not get covered with dirt or stained with oil like a blue print does. You always have them before you when changing taps. Heavy bushings eliminate breakages in shipment and handling



Station Type

Moloney Transformers are manufactured in a factory that was built especially for that purpose only. They are designed by Engineers and built by men who make a specialty of this work.



Made in Canada



Pole Type

MOLONEY ELECTRIC COMPANY OF CANADA, LIMITED

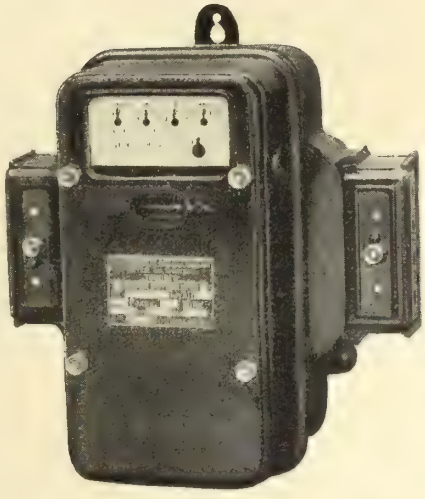
Factory
Windsor, Ont.

Head Sales Office
Bank of Hamilton Bldg., Toronto

Branch Offices
Montreal, Halifax, Winnipeg, Vancouver

Absorbs the Shock

Our special C. & H. Poly-Phase Meter is safe because it is fitted with new double terminal blocks that absorb the shock and reduce the danger of accident resulting from overloaded wires and from surge conditions during lightning storms.



This meter also has more inside room for the connections, and the three or four lines are carried straight through the meter from the left to right. In every respect this C. & H. Poly-Phase is a Safety Meter, and is undoubtedly the one to select for Installation on Long Distance Transmission.

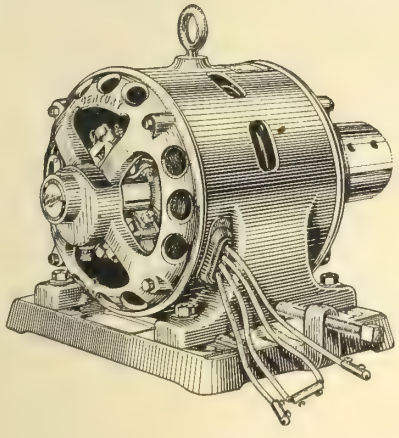
C & H Poly-Phase The Safety Meter

The Company's guarantee goes with every instrument. The new Poly-Phase is as near perfect as it is possible for a meter to be.

Get Full Information
Write the Makers

Chamberlain & Hookham Meter Co., Limited

243 College St., TORONTO 61 Albert Street, WINNIPEG
340 University Street, MONTREAL



Illustrating a 2 h.p. motor

Each size of

Century

Repulsion Start Induction

Single Phase Motors

is rated liberally and correctly for constant speed, continuous service in accordance with up-to-date engineering practice.

They Keep-a-running

CENTURY ELECTRIC COMPANY

St. Louis, Mo., U.S.A.

280

Stock carried in Canada by:

Jones & Moore Electric Co., Ltd., 294 Adelaide St. W., Toronto.
Great West Electric Co., Ltd., Winnipeg, Man.
Rudel-Belnap Machy. Co., Ltd., Can. Express Bldg., Montreal.
Rankin & Cherrill, 55 Hasting St. W., Vancouver, B.C.

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Bissett & Webb 47
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Boston Insulated Wire and Cable Co. 38
Boving Hydraulic & Engineering Co. 43
Bradstreets 50
Brandeis, Charles 50
British Aluminium Company ... ...
Bussman Electric Co. 1

Calebaugh Self Lubricating Carbon Company 16
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Electric Railway Improvement Co.. 16
Electric Service Supplies Company.
Electrical Testing Laboratories 50
Ewart & Jacob 50

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Fisher Electric Company ... ...
Flexible Conduit Company 11

G. & W. Electric Specialty Co. ... ..
Gest, G. M. Limited ... ...
Great West Electric Company 41

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Hatheway & Knott 15
Hessco Company ... ...
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Mitchell, Charles H. & Percival H. 50
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National Electric Heating Company 52
National Metal Molding Company .. 4
Nerlich Company ... ...
Northern Aluminum Company 47
Northern Electric Company 2

Ohio Brass Company 3
Onward Manufacturing Company ..
Orpen Conduit Company 15

Packard Electric Company 10
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Philadelphia Electric Company Supply Dept. 5
Phillips Electric Works, Eugene F. 37
Pittsburgh Reflector & Illuminating Company 10
Power Plant Equipment Company ..
Pratt & Whitney ... ...
Pringle, R. E. T. 52

Railway and Power Engineering Corporation ... ...
Redmonal Chemical Products Co. .. 12
Renfrew Electric Company ... ...
Ridout & Maybee 50
Robertson Ltd., J. M. 50
Robbins & Myers Company 17

Sammett, M. A. 50
Sangamo Electric Manufacturing Co.
Smith Company, S. Morgan 6
Spaulding & Sons Company, J. ... .
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Square D Company 45
Standard Underground Cable Company of Canada, Limited 41
Steel Company of Canada 3
Superior Electric Company ... ...
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Thompson, Fred & Co. ... ...
Thompson-Levering Company 38
Thordarson Manufacturing Company 47
Toronto and Hamilton Electric Co. 38
Tubular Woven Fabric Company .. 1

Walger Connector Co. 39
Wagner Electric Manufacturing Co.
Ward Leonard Electric Company .. 2
White Electrical Company, T. C. ...

THE "TYPE S" PORTABLE WHEATSTONE BRIDGE



Useful in the Shop and Laboratory for the Measurement of Resistance. Adapted for Fault Locations in Telegraph and Telephone Lines and Cables.

The Type S Bridge is a thoroughly practical instrument for shop and field use. Being complete in every detail it is ready at all times for immediate use. It is easily portable, its weight being but 8 pounds. The precision of adjustment of its coils (Rheostat 1/10 per cent., Ratio 1/20 per cent.) insures accurate measurements. The galvanometer, the weakest element of such an instrument, is unusually rugged. It is a separate element and may be removed for examination or repair by taking out two screws. The battery is of the ordinary "flash light" type, and renewals may be procured practically everywhere. The price is $66.25 net, f.o.b. Philadelphia, boxed for shipment.

Bulletin No. 530 describes this instrument.

THE LEEDS & NORTHRUP CO.

Electrical Measuring Instruments

4912 Stenton Ave. PHILADELPHIA, PA.

GALVADUCT

LORICATED



A "GALVADUCT" Building

"GALVADUCT"

The most perfect interior construction conduit on the market.

Recognized as the standard of high quality.

Always specify Galvaduct or Loricated CONDUITS

"LORICATED"

A high-class interior construction conduit of the enamelled type, proof against acid or other corrosive agents.

If your jobber cannot supply you—write us.

CONDUITS COMPANY, Limited

TORONTO



Are You Prepared

For the

Fall Drive

If not place your orders early for

MONARCH SHRAPNEL

If your local jobber does not handle our lines write direct

"Pittsburgh" Reflectors

Increase Light 500%

BY TEST



Illustration shows "Pittsburgh" Reflector No. 50 for 100 or 150 Watt Lamp. Dimensions: Height, 9½ inches, Width 10 inches. Holder 2¼ in. Form "O".

They are scientifically formed to obtain the maximum of light on the window trim. "Pittsburgh" Reflectors have attained extensive sales for window lighting, because of their saving of current and their dependability to increase lighting efficiency.

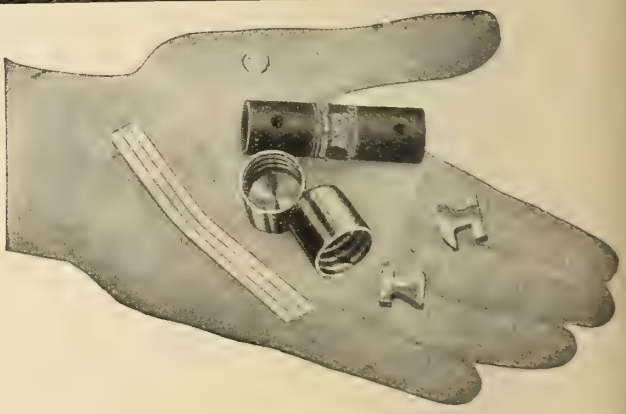
Pittsburgh Reflector and Illuminating Co.

PITTSBURGH, PA.

Canadian Distributors

JAMES DEVONSHIRE, LTD.

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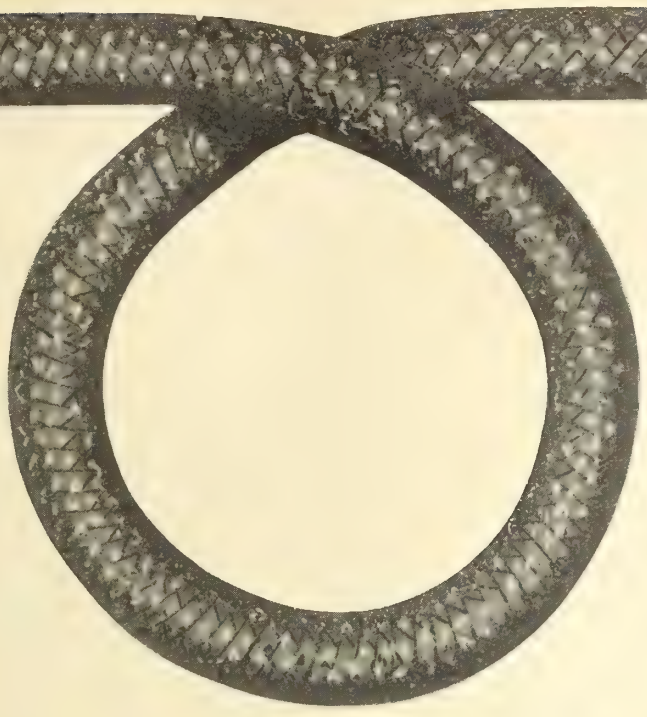
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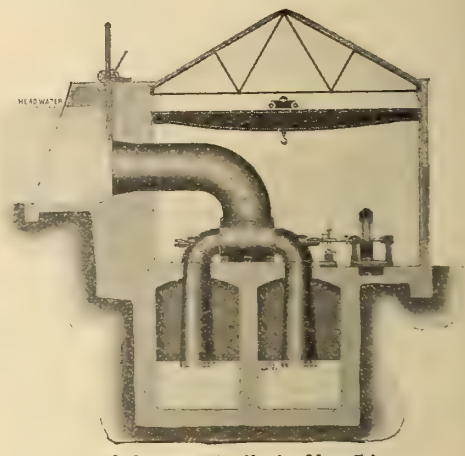
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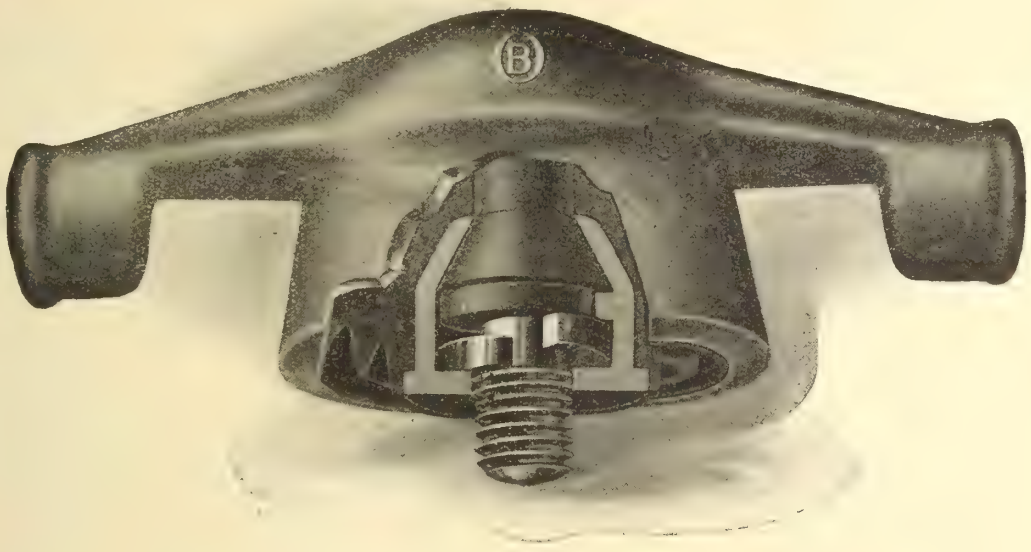
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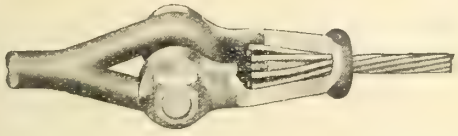
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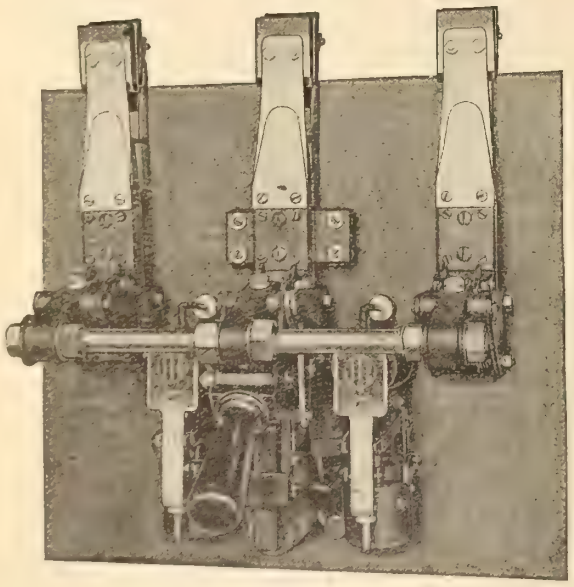
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Immediate Need For Money To Keep Street Railways Running

The full text of the report to the Minister of Labor by Chief Justice Mathers, Isaac Pitblado, K.C., and R. C. Ward, on the conditions obtaining in Winnipeg between the Winnipeg Electric Railway Company and its employees, has just been made public. The condition in Winnipeg has been aggravated in the past by the competition of jitneys, but this was recently eliminated. However, no dividends have been paid by the company since 1915, and when a recent demand was made by the men for increased wages, the company was met with the alternative of practical bankruptcy or the necessity of increasing the revenue through an increased fare. The report referred to above stated that to accede to the demands of the employees would be putting the company into immediate insolvency and the recommendation of the committee includes both that the wages of the men shall be increased and also that the fares, as already noted in previous issues of the Electrical News, shall be brought into conformity with the greatly increased costs of maintenance and operation of the system. The new wage award which was put into effect on October 1, is as follows: for the first six months, 39 cents per hour; for the second six months, 41 cents per hour; for the second year, 44 cents per hour; for the third and succeeding years, 47 cents per hour. The committee took the stand that the request of the company for increase in fares was not a matter of the history of the relations between the local street railway and the municipality, nor did it rest upon any right to a dividend upon capital invested in the enterprise. The increase must be given, however, because of immediate pressure for money necessary to keep the street railway running so that they may meet the local and national demands for their service. In justice the public should pay an adequate war compensation for a service that cannot be rendered except at war prices.

These are conditions which obtain practically all over the continent. They have been recognized as just and right in a number of cities. In other cases, however, there is still no evidence that the companies operating railway systems are to be shown any measure of justice. Whatever may be said of Germany, it apparently cannot be said of all Canadian municipalities that they have "won that victory over themselves which teaches that might is not right."

Timely Organization of Toronto's Illuminating Engineers

Shortly before the outbreak of war, there was a movement among engineers specially interested in illuminating matters, to form an association for the study and discussion of problems connected with better lighting of our homes, offices and factories, but, unfortunately, some of the moving spirits were called to active service and the matter was temporarily held in abeyance. With evidence of the struggle drawing to a close, however, interest has been again revived and a few weeks ago, a number of Toronto members of the Illuminating Engineering Society of the United States, met to discuss the advisability of further organization. A meeting was held in Mr. W. P. Dobson's office, Strachan Avenue Terminal Station, and it was decided that an endeavor would be made to hold meetings monthly, or even more frequently, for the reading and discussion of scientific and practical papers.

The first meeting of this nature was held on Tuesday evening, November 5, with Mr. H. D. Burnett in the chair, and was well attended. A semi-technical paper was read by Mr. Geo. G. Cousins, a member of the research laboratory of the Hydro-electric Power Commission of Ontario, on the subject of "Photometry." Mr. Cousins' paper consisted of an historical review of the development of photometry, a description of the various photometers in use in the Hydro laboratories and some interesting figures regarding results obtained in tests on lamps and reflectors of various kinds. Extracts of the paper are printed elsewhere in this issue.

It would seem that Toronto illuminating engineers have chosen an opportune moment to initiate concerted action along the lines of a greater knowledge of the subject of correct lighting. It is to be expected, now that the feverish haste associated with the production of war materials is a thing of the past, that we, as a nation, will have more time to consider the essentials of quality production. The contest of the next few years among the nations of the world will be won by the nation that can produce goods of the highest quality. It follows that workers, in general, must operate under conditions of the most favorable possible nature—and nothing adds more to the efficiency of a workman than proper lighting. This is equally true whether we consider the lighting of the factory or office in which he works, or of the home in which he passes his hours of recreation. Canada, situated as she is, in the more northerly latitude of the hemisphere, spends more hours than most countries surrounded by artificial illumination. This in itself constitutes an all-sufficient reason why the greatest possible care should be taken in our lighting installations. In proportion as our lighting is inadequate and improperly installed, the products of our hands and minds will fall short of the standard required to compete in the markets of the world.

Another New Industry for B.C.

The plant now being erected on the North Arm of Burrard Inlet by the American Nitrogen Products Company, will be the first electro-chemical factory in Western Canada. It marks one more forward step in the industrial advance of British Columbia. Other similar concerns should follow when it becomes generally known that the province offers exceptional facilities for the profitable pursuit of this branch of the chemical industry, because of its abundant water-power still unharnessed and its vast stores of the necessary materials.

Little is at present being made public as to the intended scope of the company's activities. However, they will, during the balance of the war, engage in the production of nitric acid for use in the manufacture of munitions, and when peace comes, in the production of fertilizer. The company is an American concern, with a capital of $2,000,000. The head office is in Seattle. An experimental plant was established some time ago in the State of Washington, and the success of that undertaking led to the expansion to British Columbia.

In the electro-chemical industry an abundant supply of pure limestone and coke in the vicinity of operation, and cheap electricity, are essential. The process is a simple one. Calcium carbide is first produced in an electric furnace from the limestone and coke. The calcium carbide is then raised to a red heat and nitrogen from the air passed over it. The nitrogen and carbide combine in the compound cyanamid. In its turn, this compound can be readily transformed into ammonia.

There are, of course, a number of slightly differing methods of electro chemical manufacture. The Badische Chemical Company of Germany use what is known as the Haber process in their plant, producing something like 500,000 tons of nitrogen products annually for the military uses of the enemy. Norwegian concerns favor the Arc process, by which a direct combination of the oxygen and nitrogen of the air is effected through the employment of the great heat of an electric arc. This process, to be economically feasible, calls for abundant and cheap electric power. At Niagara Falls, Ont., what is called the cyanamid process is employed, in which cheap power is also essential.

The American Nitrogen Products Company have adopted the Arc process. Their plant is being constructed close to the Lake Buntzen power plant of the British Columbia Electric Railway Company, with whom it is understood they have arranged for 3,500 kilowatts at a low rate, made possible by the delivery of the power at times when the British Columbia Electric Railway Company do not require it for other purposes, and because of the proximity which obviates the installation of extensive transmission lines and their subsequent upkeep.

New Power Scheme for Montreal Island

A second scheme for developing power on the Rivere des Praries, Island of Montreal, is projected, Messrs. J. R. Walker & Co., makers of sheathing felt, leather board, and friction board, having applied to the Quebec Government to construct a dam from the shore to Visitation Island, and a second dam from Visitation Island to Cedar Island. The power house is to be located on the Vincent de Paul side of the river. The company have a mill known as the Sault au Recollect Paper Mill. The scheme is understood to be in opposition to that of the Sault au Recollect Land & Power Company, referred to in our last issue, and which is backed by Senator M. J. O'Brien. The dam of the last named company would be higher up the river, but would skirt Visitation Island.

The Application of Synchronous Converters

By Mr. H. B. Dwight

When direct current is required in moderately large quantities, it may be obtained from the usual alternating-current power systems either by means of synchronous converters or by means of motor-generator sets. Of recent years, synchronous converters have been much improved, and have been gaining rapidly on the alternative apparatus, the motor-generator sets. Very large installations of converters have been made. For instance, the aluminum industry and the zinc industry have many thousands of kilowatts of converters in single installations. Many companies, including several very large steel mills, have recently adopted converters as their standard for the supply of direct current, instead of motor-generator sets, their previous standard. In railway work, converters are used in large numbers. In view of these facts, it is of interest to review the economies and advantages offered by synchronous converters.

The most outstanding economy effected by synchronous converters is the large reduction in first cost. It may be stated that, except for the smallest sizes, a motor-generator set will cost from 25 to 50 per cent. more than a converter of the same rating. This statement will apply even when the motor-generator can be installed without providing additional transformers. Transformers are always required with a converter.

An economy as important as the preceding is the higher efficiency of a converter and its transformers compared with the efficiency of a motor-generator set, even without transformers. For instance, the efficiency of a 500 kw. converter and transformers of usual characteristics is about 93 per cent. at full load, while that of a motor-generator set of the same rating is about 87 per cent. The difference is expressed more clearly by stating that the losses of the converter are 7 per cent., while those of the set are 13 per cent., or almost double. The cost of the extra power losses amounts to a large sum in a year, and may amount to 5 per cent. each year on the first cost of the converter.

One advantage of converters is that they are inherently able to commutate successfully very large overloads. This is especially useful in railway work, and some railway converters are guaranteed to carry momentary overloads of 200 per cent., that is, they can carry peaks of load amounting to three times their full load rating.

Synchronous converters can supply three-wire d.c. circuits at practically no extra expense, since the neutral can be brought out from the transformers, without the expense of collector rings and balance coils which are required with three-wire d.c. generators. Similarly, the neutral of a two-wire d.c. circuit can be easily grounded when a converter is used, and this will protect the d.c. circuit from abnormally high voltages.

The operating troubles encountered in the early years of the development of the synchronous converter, which created a feeling that motor-generators were more reliable, have now been substantially overcome, and it can be stated that synchronous converters are thoroughly reliable machines. It can also be stated that 60-cycle converters are practically as reliable as 25-cycle converters. Any commutating machine, whether converter or generator, will flash over when subjected to a heavy short circuit. The flashing of converters has been reduced so much in recent years that they are not at any disadvantage with respect to generators in this matter.

Synchronous converters cannot give the same easy adjustment of the d.c. voltages as can be obtained with genera-

ors. However, if the variation required is small, an induction regulator may be installed on the a.c. side. For somewhat larger voltage variation, up to 10 or 12½ per cent. from normal, booster converters have been used extensively. These have a small a.c. generator connected in series with the line, for changing the voltage. In certain cases low voltages may be obtained by providing taps on the transformers, and converters are now in successful operation in Canada which operate at approximately half voltage as well as full voltage by this means. Where the a.c. supply is subject to violent fluctuations in voltage or frequency, motor-generator sets may be preferable to converters.

The cost of development where special characteristics are required is heavier in the case of converters than in the case of motor-generator sets. Consequently, a standard converter should be specified instead of an odd rating. Where a standard converter cannot be used, as in the case of small sizes, or for the supply of current at 125 volts, a motor-generator set should be specified.

Converters can usually give flat compounding, that is, the same voltage at no load and full load. Higher compounding than this, while it may be desirable, is not absolutely necessary for most applications. In general, converters can operate in parallel with generators if the generators are changed so as to have the same compounding as the converters.

Synchronous converters must be operated at nearly 100 per cent. power-factor, especially for long-continued heavy loads, since low power-factor operation produces extra heating of the armature coils close to the collector ring taps. A synchronous motor of generous size and whose field current is frequently adjusted, can give much more power-factor correction or much more control of the voltage than a converter. It is a point worth remembering, however, that the most leading current is required at the time of heaviest load, and a converter, by means of its series winding, automatically provides this. On the other hand, a synchronous motor generator set may quite possibly have a lagging power-factor at times of overload, if the field rheostat is left at a fixed setting, as is often done, especially with the smaller units. Therefore, taking into account overload conditions, a converter may have almost as good effect on the power-factor and the voltage as a synchronous motor-generator set which is not carefully controlled. If the synchronous motor is large enough to be provided with an automatic voltage regulator, it will give the most leading current when it is most needed, and will hold the voltage constant by power-factor control, within the limits of its kv.a. rating.

In many countries, synchronous converters are used to an increasing extent for the supply of direct current in large quantities for railway work, electrolytic work and for d.c. motor loads. Converters are not yet used to an equal extent in Canada, and good results would be obtained if more attention were paid to the possibilities of this useful type of apparatus.

It is stated that the British Columbia Government may shortly undertake the electrification of the North Vancouver section of the Pacific Great Eastern Railway. There is said to be sufficient water power obtainable at three points to electrify the entire road to Prince George, although such an expenditure is not warranted at the present time.

The Toronto city council, it is stated, will take immediate steps to have the ban removed on store lighting, and also to have full street lighting restored. It is felt by many merchants that this would be a very considerable stimulant to Christmas trade.

Water Powers in the Maritime Provinces

By Mr. K. H. Smith*

Since 1915, active water power investigations have been carried on in Nova Scotia by the Nova Scotia Water Power Commission in co-operation with the Dominion Water Power Branch.

It has been necessary of course to give primary consideration to hydrometric work, that is the securing of adequate run-off data, of which none whatever were available in Nova Scotia prior to the inauguration of the work herein mentioned. During the past year, too, the necessity of making every possible man available for immediate military duty has further curtailed detailed power and storage surveys.

However, power investigations to date in Nova Scotia have revealed power sites with a total 24-hour capacity at all seasons of the year of about 100,000 horse-power. Maximum advantage of all these sites may be secured due to the large storage reservoirs at each site. Under such conditions, the installation warranted for the sites in question for ordinary commercial purposes would be from two to three times the 24-hour capacity given.

It is to be understood that the estimate given above is only for such power sites as have been investigated to date, and that a number of rivers on which power sites of considerable magnitude are known to exist have not yet been investigated. It should be noted, too, that a water power site located at any place within the province of Nova Scotia is within easy transmission distance of some industrial centre or shipping point.

At its last session the Government of Nova Scotia passed a Water Power Act designed to place the local government in control of all water powers with a view to removing as far as possible, legal obstacles, and facilitating in every way legitimate water-power development. The effective carrying out of this Act depends upon regulations which have not yet been put into force, but it is expected that such regulations, worked out in co-operation with other parts of Canada will be made operative at an early date.

During the past summer, a water power commission, consisting of C. O. Foss, Chairman, B. M. Hill, and W. E McMullen, Secretary, was organized in New Brunswick. The members of the Commission are all employed by the New Brunswick government in other capacities, and it is especially noteworthy that they are all engineers.

This Commission entered into a co-operative arrangement with the Dominion Water Power Branch, Interior Department, Ottawa, similar to that in operation in Nova Scotia. Water power investigations in the provinces of Nova Scotia and New Brunswick, including hydrometric surveys may therefore be carried on by a single engineering organiation which results in maximum economy and efficiency.

As was the case at the beginning of investigations in Nova Scotia, attention is being concentrated in New Brunswick on hydro-metric work. While New Brunswick was in a somewhat better position in this regard than Nova Scotia due to the activities of the bordering state of Maine and of the former International Commission, pertaining to the St. John river, still there were run-off data for the greater part of the province. Although active work was not begun until August, 10 gauging stations had been established up to the end of September, and about 20 current meter measurements made. It is considered that these stations with one or two

*District Engineer, for the Maritime Provinces, of the Dominion Water Power Branch, Department of the Interior.

...gauges to be established and those now or formerly maintained by the United States Geological Survey will give fairly satisfactory run-off data for all parts of the province.

It may be interesting to note that results from one of the new gauging stations, that on the Madawaska river, are of value to the province of Quebec, as well, and as the station is actually located in that province, the Quebec officials are assisting in its maintenance. In this particular instance, therefore, there is co-operative action between the Federal government and the two provinces of New Brunswick and Quebec with one other province, Nova Scotia, indirectly interested.

Possibly some delay in undertaking water power investigations in New Brunswick may be attributed to the fact that in the past, there has been a general impression that the province of New Brunswick was deficient in water-power. Exception was made in the case of one or two outstanding powers which were too large or too far removed from industrial centres to warrant immediate development and certain international powers on the St. Croix river.

In the course of a reconnaisance of the province primarily for the location of steam-gauging stations, a number of small moderate sized sites have become apparent, some of which offer promise of economic development at an early date, either individually or in conjuiction with others. At the same time, it is quite possible that some sites which have not been considered favorably hitherto, due to a lack of storage reservoirs and a consequent great diminution of power at certain seasons of the year, may be developed in connection with steam generating stations located at some of the New Brunswick mines to great advantage from the standpoint of cheaper power and conservation of coal resources.

For obvious reasons there has been very little actual water power development in the Maritime provinces recently.

In Nova Scotia a water power plant supplying the town of Oxford, has been improved and enlarged, including the construction of a steam reserve to utilize mill waste near at hand. The village of Lawrencetown, Annapolis County, is now installing a water power plant on the Annapolis River immediately in the village to replace a steam generating plant, the cost of operating which was found prohibitive. The town of Annapolis Royal has also made a start towards increasing the storage capacity of their municipal water-power plant.

Middleton recently bought a water-power plant about three miles from the town, which had been inoperative for some town. With a few minor repairs and the building of about 3 miles of transmission line, this development was put into service at once, replacing a gas-producer generating station. In addition to its former lighting load, the town is now supplying industrial power, and recently connected up the largest individual power user in the community who formerly had steam equipment.

In New Brunswick, a small water power development was completed some months ago to supply lighting, and industrial power in small amounts for the towns of Rexton and Richibucto. At the present time, a 2000-kw. hydro-electric station of excellent design and construction is being built on the Madawaska river at Edmundston. This development is intended to supply power for a large sulphite mill also under construction at the same place for Fraser Companies, Ltd.

In general, it may be said, that never before in the Maritime provinces were so many major power projects under serious consideration, and it seems quite probable that considerable development will take place at the first favorable opportunity. In a few cases, responsible parties are pressing to have the legislation recently enacted in Nova Scotia as outlined above made operative.

Official Meeting of American Institute of Electrical Engineers to be Held in Toronto, November 22 and 23

It is just fifteen years since a number of prominent electrical men of the city of Toronto formed the Toronto Section of the American Institute of Electrical Engineers. During these years the section has reflected the increasing electrical importance of the city and province. During the present year they captured the pennant for the greatest percentage increase in membership during a campaign which was conducted by Mr. A. B. Cooper and his committee.

In recognition of the position the Toronto Section has attained the directors of the Institute have decided to hold an official Institute meeting in Toronto on Friday and Saturday, November 22 and 23, 1918. Full particulars of this meeting are appended and every member is urged to contribute to its success by attending the technical sessions, joining in the discussions, being present at the dinner at the Engineers' Club on Friday evening, and by bringing his friends along. We are confident this meeting will prove one of the best electrical functions ever held in this city; it should demonstrate not only the activity but also the sociability of the electrical engineering fraternity.

On account of the influenza epidemic two very interesting papers have been cancelled; this ought to make every member enthusiastic about the big November meeting. A most cordial invitation is extended to members and friends to come along and renew acquaintance with old friends and take an active part in the proceedings.

PROGRAMME

Friday, November 22

1.30 p.m. Paper by Mr. Arthur H. Hull, Chairman, Toronto Section, "Electric Power Development in Ontario."

3.30 p.m. Paper by Mr. W. G. Gordon, Transportation Engineer, Canadian General Electric Company, "The Electrical Equipment of the Canadian Northern Tunnel in Montreal."

5.30 p.m. Adjournment.

6.30 p.m. Dinner at the Engineers' Club for Members, Delegates and Friends, price $1.75 per cover.

7.15 p.m. Address by Sir Robert A. Falconer, C.M.G.

8.00 p.m. Paper by Mr. S. Svenningson, Designing Engineer, Shawinigan Water & Power Company. Montreal.
"A Long 110,000 Volt River Crossing."

10.30 p.m. Adjournment.

Saturday, November 23

9.30 a.m. Assemble at the Engineers' Club for one of the following visiting trips:
(a) Leaside Munition Plant, Leaside, Ont.
(b) British Forgings Company, Electric Steel Plant, Ashbridges' Bay, Toronto.
(c) Hydro-electric Substation and Laboratories, Strachan Avenue, Toronto.

(Members should register on Friday for which ever trip they desire to make; automobiles will be provided by the accommodation is limited).

Executive, Toronto Section, 1918-1919

Arthur H. Hull, Chairman, Ashton B. Cooper, W. Percy Dobson, Herbert B. Dwight, Frank R. Ewart, William G. Gordon, Gordon R. Langley, William Volkmann, Ernest V. Pannell, Secretary.

Reception Committee

E. M. Ashworth, W. M. Andrew, E. T. J. Brandon, R. G. Black, W. A. Bucke, F. G. Clark, H. C. Don Carlos, F. A. Gaby, W. G. Gordon, H. U. Hart, Jas. Kynoch, G. D. Leacock, Wills Maclachlan, W. R. McRae, D. H. McDougall, A. L. Mudge, T. R. Rosebrugh.

Electric Welding—A New Industry

By Mr. H. A. Hornor*

About a year ago the Chairman of the Standards Committee of the Institute was requested to investigate and standardize spot welders and the apparatus connected with them. It occurred to the members of this committee that electric welding could perform an important function in increasing the progress of steel ship construction. The work which was started by the Standards Committee was then transferred to the General Engineering Committee of the Council of National Defence. Last winter the Council of National Defence abolished all advisory committees but at this time the Emergency Fleet Corporation of the U. S. Shipping Board had become so much interested in the subject that they decided to adopt the committee. The committee is composed of representatives covering broadly the whole field of welding activities in this country and, although electric welding has been the subject of all the investigations up to the present time, it is now proposed to include gas welding with representatives from all the gas welding associations and companies connected with the industry.

The two main processes of electric welding, namely, arc welding and spot welding, were found by this committee applied in the first case to repairs and in the second case to certain factory quantity production jobs. The work done was in the case of spot welding only on light material, and in neither case very extensive. The processes to be successful in their application to the construction of merchant vessels would have to show reliability in the joining of steel plates from a half-inch to one inch in thickness. To this and kindred problems the committee immediately turned its attention.

The work had all been done in the field where it had been applied by practical men. It was first necessary to formulate the proper nomenclature and symbols. This was thoroughly investigated and a very comprehensive set of symbols has been approved by the committee and is in daily use by those now actively engaged in this new application. The approved nomenclature introduces the subject to the designing and calculating engineer and gives him the instrument by means of which he is able to place his thoughts rapidly and conveniently on drawings.

The manufacturers of apparatus joined the practical man in the study of the problems of electric welding. Apparatus and so-called processes introduced various types of machines suitable for the conversion of electrical supply to the proper values of current and voltage needed at the arc or at the spot. The manufacturer in his eagerness to meet the problem naturally encountered many difficulties. These difficulties increased until a point was reached as referred to above where he demanded some standards upon which his apparatus could clearly be rated. Therefore, the manufacturer was only too pleased to co-operate with the Welding Committee and is to-day conscientiously aiding in straightening out the difficulties in which he was involved prior to last year.

Arc welding in this country has largely been done in the railroad repair shops. It was discovered that the process was much cheaper and could be performed more rapidly than by any of the gas welding methods. It also could be applied without preheating and in many cases without the expense of disassembling complicated pieces of machinery. Spot welding besides being used in many different industries was sought for by the railroad man and there has been built a gondola car which has seen some seven or eight years of service. It is interesting to note here the difference in practice between Great Britain and the United States. The former knowing little or nothing about spot welding had the practice and application of arc welding very well under way; the latter exactly the reverse.

Apparently the attempts to train operators were rather crude and it was early observed that the reliability of the electric weld depended substantially upon the skill of the welder. The manufacturers of apparatus and the superintendents in railways shops had struggled with the problem of training operators but intensive study had not been given the subject so that there existed in this respect a great deal of groping in the dark.

Present Status of Electric Welding.

Investigations were immediately undertaken to answer the question whether spot welding could be successfully accomplished using one-inch thick steel plates. An experimental apparatus of large size was erected and put into operation, the results showing that no difficulty was encountered with half-inch and three-quarter inch plates. The same remark applies to one-inch steel plates. In fact, this experimental machine was successful in welding three thicknesses of one-inch plate a condition which far exceeds the requirements of merchant ship construction. This operation has its historical significance in that this was the first time that any spot welding of this magnitude had been performed. The successful outcome of these experiments has led to the design and construction of large spot welders to be used in the fabrication of ship sections. The practical application of a large five-foot spot welder will be made at a demonstration of a forty-foot section of a standard 9600-ton ship to be built at the plant of the Federal Shipbuilding Company, Kearney, New Jersey. This is the largest portable spot welder ever built. It will prove two points in ship construction by the electric method, namely, the clamping of the ship's structural parts for assembly thereby reducing the time in working the material as well as for the erection of the ship material; and secondly, by the speed of spot welding it will prove the decrease in time for joining the material together. The consensus of opinion is that the large stationary spot welder of five or six-foot gap will undoubtedly play an important part in increasing the speed of fabricating sections of standard steel vessels. Further investigations are being made and designs are being worked out for special spot welders for use in the construction of bulkheads. The designs proposed are chiefly for shop processes, but it can be asserted that such apparatus will be of undoubted value in the saving of time and man power.

Arc welding had been tried in a great variety of work but there was no conclusive evidence that it could be developed to the stage of joining ship plates with the certainty of full strength. The first stage of this investigational work is now almost completed. Sample welds of half inch ship structural steel were taken by a special sub-committee to fourteen or fifteen different places where electric welding was done, noted the conditions of current, voltage, electrode, operator, etc., and then prepared the welded samples for tests. The samples were forwarded to the Bureau of Standards in Washington so that the tests should be conducted by parties absolutely disinterested and without knowledge of how the samples were obtained. The results of these tests showed a remarkable similarity especially when it is realized that they were made by several firms with different electrode materials and under varying conditions of the electrical cur-

*Read before the A. I. E. E.

cent. Practically all of the welds pulled at over 50,000 pounds per square inch and several over 60,000 pounds the average being about 58,000. On the bending test one of the samples was bent to an angle of 78 degrees before a crack started and final failure reached 80 degrees. In another case the sample was bent to 65 degrees before the crack started and final failure did not occur until 86 degrees. The point of importance here is that all the welds showed a reliability and satisfactoriness which makes conclusive the opinion that electric arc welding is applicable for the joining of steel where the structure is submitted to live loads, bending strains, static pressure, or the like. The Sub-committee on Research is pursuing this subject and practical samples are being prepared for similar tests using three-quarter and one-inch stock material. The results of these tests will be available as soon as the reports are presented and approved by the Welding Committee. The Research Committeee is also preparing various types of joints in heavy plating. These will be submitted to all the regulation tests and in addition to shock and fatigue tests and tests to destruction.

To give a further indication of the large size practical tests which are being carried on at the present time it may be stated that three 12-foot cube electrically welded tanks are now being constructed. These tanks are built in such a way that from twelve to fifteen different designs of joints are used in their construction. After these tanks are built they will be subjected to a static strain and the deflection of the seams will be directly measured. Afterwards they will be tested by external shock and crushed to destruction. Portions of the joints will be cut, sent to the Bureau of Standards, and again tested for the sake of accumulating precise data. In this connection there is being built at the Norfolk Navy Yard a battle-towing target. The keel of the target 110 feet long will be entirely electrically welded and the results of this practical demonstration will be carefully recorded after it has been put in regular service.

Alternating Current Found Advantageous.

It is to be expected that the manufacturers of apparatus being keenly observant of the increased interest in electric welding as well as in the future, which is probably now unquestioned, would be active in their desire not only to improve their present facilities and their design of apparatus, but also to proceed themselves to follow the trend of the investigations made by the Welding Committee. The consequence of this has been a large increase in output of apparatus that is needed. One interesting point is that certain manufacturers who were decidedly of the opinion that direct current was the only proper current to use for arc welding have within a very recent period changed their point of view and are willing to admit that alternating current may have certain advantages in the development of this art.

The electric arc requires a reduced voltage and this is difficult to attain with direct current without relatively expensive machines or a useless expenditure of energy. The practice in this country in manufacturing establishments of any size has been toward an increase in the supply voltage so that very few large manufacturing plants use less than 220 volts direct current. With this voltage the only economical method of transformation is in the use of a motor-generator set. The efficiency in this case is in the neighborhood of 50 to 60 per cent. It is possible to use a supply voltage of 110 volts with a variable resistance which cuts down the voltage to the arc volts. This gives a very poor efficiency. In the case of alternating current the supply voltage can be reduced by a transformer which will supply as in the case of direct current a sufficient voltage for striking the arc and a satisfactory reduction when the arc has been struck. On the other hand, if a low voltage alternating current is provided a simple reactance may be introduced which has some of the same wasteful characteristics of the resistance used with the direct current. The average apparatus will permit of electric arc welding consuming about six to eight kilowatts per welder, but if low voltage is provided there are certain outfits which will reduce the consumption as low as three and one-half kilowatts per welder, or even less.

Without entering into an elaborate analysis of the relative costs of electric welding, it may be broadly stated that there is hardly any question that the electric process is cheaper than any other. The same may be said as regards speed and also reduction of man power. In a recent discussion of this subject President Adams stated that at one of the Eastern shipyards the total number of parts on the welding program of the standard riveted ships now building at that yard amounted to 225,000. The labor cost for riveting these pieces is about 245,000 dollars and for welding about 99,000 dollars making a saving of 146,000 dollars. But this is only a drop in the bucket when compared to what might be profitably done in this line. He stated further that in certain particular instances the saving is as great as 90 per cent.

One of the interesting questions discussed with some fervor by the members of the Welding Committeee is the advantages of the bare and covered electrode. Regarding this discussion no definite facts can be stated. In England the practice has been to use the covered electrode which protects the welding arc from contact with the air thus guarding against too great a formation of oxide. The practice in the United States up to the present time has been largely bare wire. Recently, American investigators have discovered the important fact that there are advantages in the covered electrode and many experiments are now being made, some with results. It is important to observe that in the above mentioned tests of welds, the best one of these samples was made with a coated (not an asbestos covered) electrode using alternating current. The point in this case seems to rest upon the question of the ducility of the weld and it would seem that the bare electrode does not make as ductile a weld or at least one as easily bent as the coated or covered electrode. The question of the ductility of the weld is one of much importance in the application to ship construction and will doubtless be of importance to other allied industries. It is, therefore, a question of serious importance and constitutes an important part of the work of the Sub-committee on Research.

No matter what the type of electrode is nor its composition, no matter what kind of shank material is to be welded, no matter what kind of apparatus is employed, the reliability of the weld rests mainly upon the man who welds it. This man if he has been properly trained and is skilled in the art knows instantly whether he is making a weld or not. He becomes after much practice able to judge fairly well upon looking on a finished weld whether it is a good weld or not. The work of training electric welding operators early became a part of the functions of the Education and Training Section of the Emergency Fleet Corporation. The men connected with this work are members of the Welding Committee. Schools for the training of operators as well as for the conversion of operators into instructors, are established in many parts of the country. The objects held in view by the training department are first to give the man intensive practice work so that he becomes a good craftsman. The methods are simple to start with, as the exercise of the right arm muscles must become flexible enough to permit the operator to give the required movement to the electrode. By a graduated series of exercises this is accomplished in about eight weeks. The man is allowed to do production jobs in the shop which gives him confidence through responsibility. It becomes desirable at this time to give the man some outside work on ships and where this is practicable it is done. The man is then turned over to an instructor who gives him an intensive

course in pedagogics lasting from five to six weeks. At first sight it would not seem necessary to so instruct a man but it is not generally understood that teaching after all is itself a trade. The experience with the men in this respect is most interesting. In nearly every case the man has resented this course at the start but at the end has turned completely around and in many cases has desired an even more extensive training. What is really accomplished is to give the man the necessary confidence to impart the knowledge that he has gained to another green man. The men under training are taken from the various industries especially the shipbuilding industry and after they have finished their instructor course are returned to their employer to carry on the instruction, in their own plant. The men who go through this training as provided by the Emergency Fleet Corporation are certificated when they have shown themselves to be entirely proficient. It is not possible nor expedient for the Emergency Fleet Corporation to require the certification of all electric welders. It is the consensus of opinion that all industries doing serious work with the electric arc should use men who are certified as to their ability in the art of electric welding. The main reason for this opinion is that the operator must be a conscientious workman or the weld will not be of perfect quality.

This brings forward another problem upon which a great deal of experimental work has been and probably will continue to be done, namely, a practical and scientific method of testing a welded joint it has been made. There have been a number of suggestions made for the solution of this problem. They are briefly, as follows:

(a) Mechanical. By hammering the weld or by chipping at frequent intervals.

(b) Electric. By means of resistance or voltage drop.

(c) Magnetic. By means of the permeometer or the change of conditions of the magnetic circuit.

(d) X-ray. By means of an exposure on an X-ray plate.

At the present time none of these suggested methods have been productive of conclusive results and recourse must be had to the purely mechanical methods of striking heavy blows on, or adacent to, the weld or by using a chipping hammer and making intermittent examinations. It would seem by far the best procedure to make the inspector proficent in the art so that he may closely observe the welders while at work. This may be accomplished by a two or three weeks attendance of inspectors at any one of the electric welding training centers.

Methods of Electrice Welding.

There are many methods and processes of electric welding but the two main ones that interest the committee at the present time and alone have been mentioned so far are the spot welding and arc welding. It may be a surprise to some of the old time welders to consider electric welding as a new industry. In substantiation of this statement it may be well to describe briefly what is meant by electric welding as it is practiced to-day.

Spot welding is not much different in the methods of procedure or in design of apparatus than when it was first introduced. Copper electrodes, water-cooled in the heaviest machines, are placed on opposite sides of the material to be welded together. The joint is a lap joint. Machines are now so designed that two spot welds may be made at one time. The routine of the operation is as follows:

The electrodes are brought into contact with the materials to be joined, current is supplied sufficient to give the required heat, pressure is then applied, the current is removed, and the pressure is removed, the weld is then complete.

The operator has a perfect indication of making a good spot weld by the use of a button placed under the electrode observing which he knows exactly the proper timing of the operation. There is therefore no question as to a good, bad, or indifferent, spot weld. Automautic spot welders have been designed and built, but it is the general opinion that they add complication to a process which in itself is very simple.

The process of arc welding is as follows:

One side of the electric circuit is connected to the material to be welded, the shank material is usually prepared by bevelling the edge of the pieces to be welded together. The other side of the electric circuit is connected to the electrode. By touching the electrode to the shank material the arc is drawn. The skilled operator now moves the electrode from side to side of the groove giving a semi-circular motion while at the same time moving the electrode along the groove.

It is important that the arc "bite" into the shank metal creating a perfect fusion along the edges and the movement of the electrode is necessary for the removal of any mechanical impurities that may be deposited. In the coated electrode it is further necessary that the slag which forms for the protection of the pure metal be worked up to the surface and it is extremely important in the event of a second or third layer that the slag or impurities be carefully scraped away before the virgin metal is again laid on.

The operator in arc welding is protected with either a hand screen covering his face with special glass through which to observe his work. The electric arc emits dangerous invisible rays in both the upper and lower spectrum scale and it is quite evident that both the infrared and ultraviolet are dangerous in their effect, the former is pathological the latter actinic. The operator further uses gloves for his hands and for the very difficult work of overhead welding it is necessary for him to use a helmet which partly covers his breast.

Developments.

The tendency of developments in spot welding has already been slightly touched upon. In their nature as applicable to shipbuilding the advancement will naturally have to proceed toward means for accomplishing spot welding in very cramped locations. This makes an exceedingly difficult problem as the power requirements are such as to preclude any very small device. In riveting one-half of the apparatus is on one side of the work and the other half on the opposite side and it is difficult to conceive of any method of spot welding that will admit of such an arrangement. In shipbuilding it is quite probable that designs may be made that will permit of a large or at least increased amount of spot welding in the actual construction of the vessel. Certainly, present designs of riveted ships will not allow of this to any great extent. As already stated, spot welding can now take its place in the fabricating shops and it is to be expected that within a few months spot welding will begin to supplant riveting in this field. The only drawback to this will be the sufficient production of spot welding apparatus.

The tendency of development in arc welding is toward the automatic machine to obviate the responsibility that has to be placed upon the skilled operator. Intensive work has been done within the last few months in the line of automatic arc welding machines and at the present time sample tests of welds made by such apparatus have been sent to the Bureau of Standards. These machines will occupy a very important position in repetition work. They will not immediately supersede the skilled operator in repair work, or in special jobs but it may be expected that the development of such machines will bring apparatus which can be man-handled and will eventually take the place of most of the hand work as it is now known.

Of the scientific advancement in the art of electric welding there is so much to be treated that only a general outline can be considered at this time. The research work has only just begun. Practice has preceded the scientific investigation.

The field, therefore, is full of most interesting problems. Those who have been following the development of the past six months are deeply interested to know the fundamental reasons. The investigational questions may be grouped into three main divisions:

1. Metallurgical; 2. Physical; 3. Electrical.

The metallurgist has yet to tell us what the conditions of the metals are after the electrode material has fused with the parent metal, and to determine what the proper conditions must be to produce a good weld. This problem has in it a great many variables. The physicist must explain the atomic or electronic conditions which permit of the combinations at the high temperatures involved and must explain the phenomenon of overhead welding. The electrical investigator must determine all the various phenomena connected with the preferences between and the advantages of the use of different forms of electrical energy and the varying characteristics of the electric circuit in producing different type of welds.

Conclusion.

From the preceding remarks it must be conceded that the Welding Committee of the Emergency Fleet Corporation has already crystalized the problems connected with this art. The working functions of this committee have been laid down upon the broadest possible lines. Liberal opportunity has been given every one to state in detail his opinion and to express the reasons for his preference on every point connected with this subject. The committee goes even further than this. It furnishes those interested with every new idea that is brought to bear upon the subject after sifting from the suggestions any question of doubt or misstatement of fact. All suggestions of improvement or problems of special application are gladly taken in hand, thoroughly investigated and reports made. It will welcome any comments that those connected with the industries may desire to lay before it. The personnel is at the present time such that it can devote not one but many minds to the solution of any specific problem that is laid before it.

The committee early discovered that the literature of electric welding was very much clouded by misstatement of fact or half-baked theory and much of the time of the committee has been taken up in disproving such statements. In order to spread the results of this work to all quarters a handbook is now being prepared which will contain only definite facts and results of investigations as are approved by the whole committee. This handbook will be made available to all those who desire to acquaint themselves with the proper means of accomplishing good and reliable electric welding.

Why Single Out Electric Railway Companies for Condemnation

The opposition to increased fares on the Winnipeg Electric Railway System has advanced the argument that the company ought to have built up a sufficient reserve to carry them over this period of high prices. So, perhaps, they should. So, also, should every other of the thousand and one business concerns operating in Canada. Unfortunately, however, they didn't know what was coming and the un-understandable feature of the whole situation is that street railways should be singled out for unjust treatment. Where is there in Canada a single commodity that has not gone up in price, except street railway fares. General Manager McLimont, of the Winnipeg System, is quoted in reply to this criticism as follows:

"How much money did you save during the boom days—the days of prosperity before the war?

"Did you lay aside a reserve during those prosperous, piping times of peace, in anticipation of these stressful seasons of war?

"The argument has been advanced, in connection with the Street Railway situation, that the Winnipeg Electric Railway Company should have laid aside, during the days of financial plentitude, a reserve which, in the eyes of the critics, should have been sufficient to enable the company to continue selling its product—transportation—during war-time, at pre-war prices.

"It is a great idea—on the surface. In a nut-shell, the Winnipeg Electric should have done what no other corporation, firm, merchant or individual citizen did, and should thereby have demonstrated a vision unparalleled on the North American Continent and a foresight outrivalling that of any human being outside of Berlin.

"The only thing that prevented the company from doing differently from anybody else, was the fact that the authorities at Potsdam failed to 'tip off' the Winnipeg Electric Railway Company to what was impending. The Kaiser and his confederates hatched up the plot when the detectaphone was out of order.

"If one started in to condemn everybody whom the war has placed in a position of temporary financial embarrassment in this Western country, the Kaiser's projected war of 1940 would be started before the work of condemnation could be satisfactorily concluded.

"The Winnipeg Electric Railway Company now has to meet an uncontrollable difference of more than $600,000 between the money it earns and the money it has to pay. The largest proportion of that sum is represented in wages, which will be circulated by more than a thousand families in and around this city.

"It would be futile to turn to those families and tell them that they should not ask employers for increased revenue to meet the increased cost of living, and that they should have saved up during pre-war times, enough money to carry them over until the end of the war without any increase in wages.

"Is it not equally inconsistent to tell the company what you would think it folly to tell its employees?

"The $600,000 has to be found in order to keep the service running. The company is not asking for money to pay dividends. Dividends? Why they are now merely a distant recollection—just like the savings accounts the workingmen had before the war.

"After most careful computation it is found that a six-cent fare will yield this company only just revenue sufficient to meet its outlay under these new war burdens. This company was prosperous once—at a time when everybody else was prosperous, during the boom years, when everybody, including the Winnipeg Electric, was spending money as freely as everybody else, with abundance of faith in the future.

"The C. P. R. paid dividends before the war; it has paid dividends ever since the war began. It has no deficit. But when the Railway War Board increased railroad workers' wages and the C. P. R., with other roads, asked an increase in freight and passenger rates, did the Dominion Government or the Railway Commissioner say: 'No, you should have set aside a big reserve in the palmy days before the war?' The increases in freight and passenger rates were granted.

"Why single out the Winnipeg Electric Railway Company and condemn it for being temporarily embarrassed by war-enhanced expenses? The company is confident that thoughtful citizens will co-operate in order that its public service may continue and that employees dependent on it may receive a living wage."

The Montreal Tramways Company have let contracts for repairs and extensions to their car barns at Vitre, de Fleurimont, and St. Antoine Streets.

Photometry and its Application to Commercial Needs

By Mr. Geo. G. Cousins*

Photometry is to the illuminating engineer what the rule is to the carpenter, the scales to the grocer, or the thermometer to the chemist. It has made possible the vast accummulation of data on which the science of illuminating is built and furnishes a means whereby the accuracy of the theory is checked. Photometry and illuminating engineering have advanced hand in hand. The advances made in illuminating engineering have been made possible chiefly by the use of photometry and on the other hand photometry has been developed to meet the growing demands of the engineer.

The first literature on the subject was a book published by Lambert in 1770. Until recent years photometry was used only to measure the candle power of light sources, but its use is now very extensive and includes many uses not thought of until recently. The earliest experimenters in photometry realized that the strength of light could not be measured directly but that the intensity of one light could be expressed in terms of that of another which thus becomes an arbitrary standard with which the unknown light must be compared. This is the principle of all practical photometry at the present time.

Photometry is used at present mainly for the measurement of candle power, flux, illumination intensity and surface brightness. This classification does not include spectro-photometry and objective photometry, the one being a rather specialized branch and the other a method by which the human eye is eliminated as the measuring instrument. The eye simply reads the result of the measurement by observing the position of a pointer on a scale. Objective photometry is based on the principle that under certain conditions small currents will flow from certain metals when exposed to light. These currents are proportional to the intensity of the light causing them and are used to deflect a mirror of a galvonometer or electrometer, the magnitude of the deflection indicating the intensity of the light. This has not yet graduated from the experimental laboratory and it is necessary for us to fall back on the eye as the final referee; upon its ability to judge equality of brightness, or to detect small differences of brightness, depends the success of a determination. The eye is effective in making such a determination with any degree of accuracy only under precise conditions. The two lights being compared must be of the same color when presented to the eye. If a difference of color exists in the lights themselves some means must be used to change one or both. The most commonly used method is the use of colored glasses to absorb some of the excess color of one light. The transmission of these glasses must be known and compensated for in the interpretation of a result.

In a laboratory where conditions are under good control a flicker photometer may be used to measure lights of different color. This presents the two colors alternately at such a rate that the resulting sensation is that of a single color, which is a blending of the two. The speed of the alternations must be such that the flicker disappears when the photometer head is at a certain point between the two lights and reappears with a slight motion one way or the other. In other words, when both lights are of the same intensity at the photometer head the flicker disappears and the slowest speed that will accomplish this is the most sensitive for the instrument.

A discussion of photometry naturally leads to a discussion of light sources and each has its effect on the other. Some types of photometers are suitable for the measurement of some light sources and not for others. The advent of the gas-filled lamps caused more extensive changes in the practice of photometry than any other single event for a great many years and it might be well to consider the differences between the vacuum and gas-filled lamps that necessitated such changes.

Before gas-filled lamps appeared on the market the vacuum lamps were commonly rated according to their mean horizontal candle power and this rating gave a very fair means of comparing different lamps of the same type. However, for many years lamp and illuminating engineers, especially the latter, had realized that this rating was not altogether satisfactory. In order to use existing lamp data in illumination calculations it was necessary to convert the value of candle power, which is the intensity,, into one of total light flux, the unit of which is the lumen. This conversion is done by determining the ratio of mean spherical to mean horizontal candle power and then multiplying the mean spherical candle power by the factor 12.57 (4π) to obtain the lumens. This ratio of mean spherical to mean horizontal candle power is constant for vacuum lamps of each type, but its determination is a long tedious job. In spite of its short-comings, however, the candle power rating had become so deeply rooted that it was too big a task for any isolated body of engineers to make a change.

Now when gas-filled lamps were measured for mean horizontal candle power in the ordinary way some very peculiar results were noticed. With the lammp stationary, the candle power was lower and the current higher than with the lamp rotating at the ordinary speeds, at the same voltage. This higher efficiency while rotating is caused by the gas in the bulb being thrown outwards by centrifugal force to the walls of the bulb. This left the filament in a more rarified atmosphere and of course was not cooled to the same extent by the gas as when stationary. The temperature increased, which in turn increased the resistance and the current consequently decreased. At every change in speed there was a change in efficiency. A peculiar feature of this is that starting with the lamp stationary and slowly increasing the speed of rotation the efficiency at first decreases then increases and at one speed is the same as the stationary efficiency. This speed is usually about 20 to 40 r.p.m.—not enough to overcome flicker. This condition put a serious damper on lamp rotation. It was found that in some lamps there were fairly large differences in candle power in different horizontal directions and the candle power in one direction might not be anywhere near the m.h.c.p. Again it was discovered that for lamps of the same make and construction there were considerable differences in the spherical reduction factor, and that the spherical reduction factor varies during the life of a lamp. Here is another fundamental difference between vacuum and gas-filled lamps: in a vacuum lamp the filament material as it is evaporated travels in straight lines to the bulb the same as the light and the result is that at any stage of lamp life the blackening at any portion of the bulb is proportional to the amount of light passing through that portion. This results in the spherical reduction factor remaining constant throughout life. The gas in the gas-filled lamps rises as soon as it is heated by the filament and these currents of gas carry the evaporated filament material to the upper part of the bulb and the mean spherical c. p. decreases more rapidly than does the mean horizontal c. p.

In view of these difficulties it was quite evident that a new method of measuring was needed. Here was a condition that

*Before a meeting of Toronto members of the Illuminating Engineering Society.

made necessary the adoption of a rating based on the total flux of light from the lamp, the method that had been advocated for years but which lacked a condition of necesity to compel its adoption. At that time there were several different types of integrating photometers in use in various laboratories, but none gave such promise of adaptation to the peculiarities of the gas-filled lamp as the sphere and its use has become universal. The sphere can also be put to many different uses as will be described later.

Routine Photometry.

Now for routine photometry. The measurement of vacuum lamps should by precedence come first. This branch of photometry is about the simplest of any. A vacuum lamp does not mind what position it is burned in and has no definite peculiarities that demand extra precautions in its measurement. Vacuum lamps are the most suitable lamps to use as standards and this results in a good color match. In our own laboratory acceptance tests are made on vacuum lamps on the m. h. c. p. basis. The lamps are measured for c. p. and watts and target diagrams are made on which the

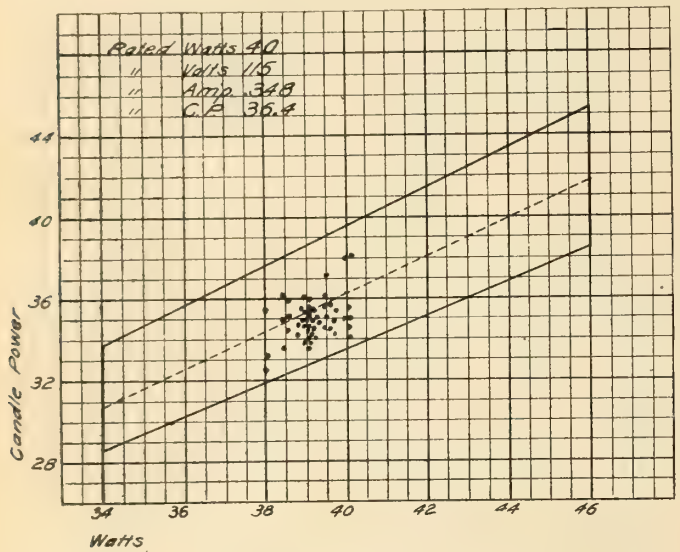


Fig. 1—Target diagram showing the measured efficiency of 40-watt tungsten lamps

rating of each lamp is shown by the position of a dot on the diagram, Fig. 1. The comparison device used for this work is the old familiar Bunsen screen. Speed is of more importance than a high degree of accuracy and the Bunsen screen permits speed of operation with a minimum of eye-fatigue. As lamps are being so measured one lamp out of each tray of 50 that is near the average watts and c. p. is selected to be further measured for life test, with more care as greater accuracy is required. For this purpose a Lumner-Brodhun photometric device is used and is capable of very high accuracy. Life testing of stock lamps is done at rated efficiency and the voltage is adjusted to produce the required efficiency.

The photometer on which this testing is done is not unlike others built for the same kind of testing but a brief description of it may be of interest. The comparison lamp is at the right end and the test lamp socket at the left; the distance between them is 100 inches. A batch of lamps being measured may include a range of from 10 to 100 watts and with such a wide range one candle power scale cannot include all and we have found it necessary to use three. These are calculated for 16, 32 and 48 c. p. comparison lamps respectively. If three comparison lamps of these c. p.'s were used it would necessitate that each be calibrated separately and this requires considerable time. In order to overcome this we use one lamp that normally burns at 48 c. p. and it is calibrated by using standards of 22, 36 and 100 c. p. These are placed in the test lamp socket one at a time, the photometer head is set at the rated c. p. of the standard and the voltage across the comparison lamp is adjusted until a balance is obtained. With the standards mentioned these balances occur at the ends and near the middle of the c. p. scale and the average voltage of the comparison lamp is taken as its working value. When it is desired to use the 32 c. p. scale with this lamp, a rotating sectored disk is placed between it and the photometer head. This particular disk cuts off 1/3 of the light and the effective c. p. then becomes 32. In a similar way the 16 c. p. scale is used with a sectored disk that cuts off 2/3 of the light. By this means we have a range of from 6 to 125 c. p. with one calibration of the comparison lamp. The change from one scale to another involves but a moment of time. This range includes all the vacuum lamps likely to be met with. In operation the photometric observer sets the voltage of both lamps and observes the c. p. The other operator reads the current or watts and does the recording. The test socket is made in 4 sections held in position by an endless spiral spring so that when the socket is rotating lamps can be placed in or taken out without stopping it.

After all I have said about the lumen rating you may be wondering why our tests are made on the c. p. basis. This is because our specifications have not been changed since the lumen rating has come into general use and these specifications are based on the c. p. rating. Also our c. p. photometer is capable of more rapid use than the spheres.

The integrating sphere photometer for the measurement of light sources is based on the theory that with an interior white diffusing surface the brightness at any point of the sphere wall is proportional to the m. s. c . p. of the source of light within. This theory is strictly true for an ideal condition when no foreign body to the light source is present in the sphere. To measure the illumination on the sphere wall a small portion of it is removed and a test window of diffusing glass substituted. A photometer track is placed so that the light passing through the test window is balanced against that of a comparison lamp which has been calibrated with the sphere. It is necessary that none of the light from the test lamp shines directly upon the test window and this necessitates a screen being placed between the lamp and the window; see Fig. 2. This screen constitutes a foreign body and is a source of error. The lamp socket and other necessary fittings add to it. The screen divides the sphere into three areas; the first surrounding the test window receives only reflected light; the second forming the greater part of the sphere receives both direct and reflected light; and the third, opposite the test window, is entirely screened from it. The errors caused by this condition can be minimized by using a screen as small as possible and placing it so that the shaded areas are as small as possible. In spheres where the screen is small in diameter compared to the diameter of the sphere and the precautions stated are taken the errors are usually of negligible proportions. A sphere paint of very high reflection factor also tends to keep down errors.

The most effective safeguard against large errors is probably the use of the so-called substitution method of calibrating the sphere. This simply means having the standard lamps as near like the lamps to be tested as is convenient and placing them in the position during calibration that will later be occupied by the test lamps. In this way errors of the instrument are largely compensated for in the calibration. Each sphere has its own constant which is affected by the reflection factor of the surface and the size and location of the screen.

The measurement of the m. s. c. p. or the lumens of a lamp is a comparatively simple matter but when larger units such as reflectors or globes are measured, to determine the losses due to them, the conditions become more complicated

nd require a more intimate knowledge of sphere photometry, igs. 3 and 4. These show that more screens are necessary nd the sphere must be calibrated with all the apparatus, in- luding the test unit, in place, where it will be during the test, nd the standard lamp must be left there, extinguished, dur- ıg the measurement of the test unit. To measure the test nit the lamp to be used in it is measured in its normal posi- on but without the reflector or globe in place, the auxiliary is ut in place and another measurement made. The second will e smaller than the first by an amount equal to the loss

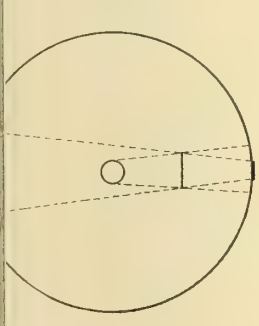
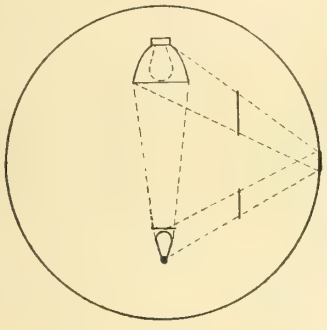


Fig. 3



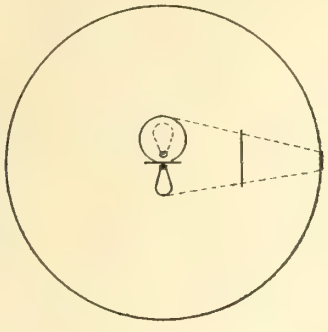


Fig. 4

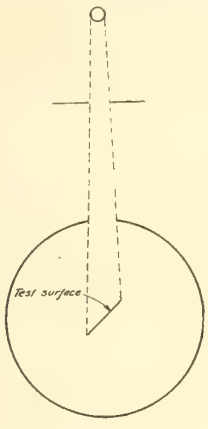


Fig. 5

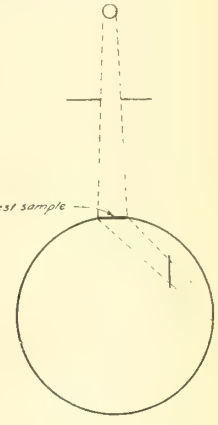


Fig. 6

aused by the reflector or globe. Globes for street lighting re sometimes purchased under specifications that place a imit on the absorption. This is very easily measured. Our arge sphere is provided with hinged trap doors in the top hrough which large units may be lowered and the opening losed up if desired. Or an arc lamp may be measured with he upper casing outside the sphere.

Illuminating engineers frequently need data on the re- lection factor of wall papers, paints and other surfaces that bsorb light. This is measured in a small sphere. A surface whose reflection factor has been determined must be used as a standard with which to calibrate the sphere.

A mirror or a surface of magnesium carbonate or other similar surface is suitable for use as standards. Standardizing such a surface is rather a long job, requiring the measurement of the reflection of a great many angles, Fig. 5. With a standard surface placed in the sphere and turned away from he test window a beam of light is directed into the opening at the top so that it falls on the standard. A measurement is hen made from which the flux of light entering the sphere is calculated. The standard surface is removed and the test surface put in its place. From a measurement with this the amount of light reflected from the sample is calculated.

The transmission of transparent and translucent materials is made by causing the light to shine through the opening in the top of the sphere and then measured, Fig. 6. This gives the value, which is 100 per cent., all of the light having passed through the clear opening. A sample placed over the opening will absorb and reflect some of this light, the re- mainder being measured and the result expressed as the per- centage of the light transmitted. If a sample so tested is of a diffusing characteristic it is necessary to state the charac- teristic of the beam of light because a concentrated beam will give a different result to a beam of diffused light. However, to test different samples the results can be compared if test- ed under similar conditions. Also if two sides of a sample are not similar the results may not be similar and a statement should be made as to which side is turned toward the light. This is shown by a test of ribbed window glass which trans- mits 90.3 per cent. with the opposite side out. Clear window glass transmits 87.3 per cent.; wavy wired glass clean trans- mits 75.2 per cent.; a dirty sample transmitted 38.4 per cent.

A person confronted with the task of selecting diffusing globes has to compromise between two opposing factors, transmission and diffusion. Both are highly desirable, yet one is obtained at the expense of the other although not necessarily to the same extent with different makes. The transmission is measured by the sphere photometer and the diffusion by a different means. There are different ways of expressing the degree of diffusion, but one in common use is to measure the distribution of brightness across the pro- jected area of the globe. If a globe has a lighted lamp inside it has the appearance of a disk and if the diffusion be perfect it will be uniformly bright all over its area, otherwise the center will appear brighter than the rest. If an opaque screen with an opening in the center is placed in front of the globe the candle power per square inch of the globe area exposed can be measured. This opening may be square inch area and should be fixed and the globe arranged so that it can be moved across the photometer track, measurements being made at convenient intervals. These results plotted in the form of a curve show the variation in brightness from the center to the edge. This method can also be used with flat samples of material.

Another very important use of photometry to illuminating engineering is the measuring of the distribution of light from various lighting units. There are many forms of photometers

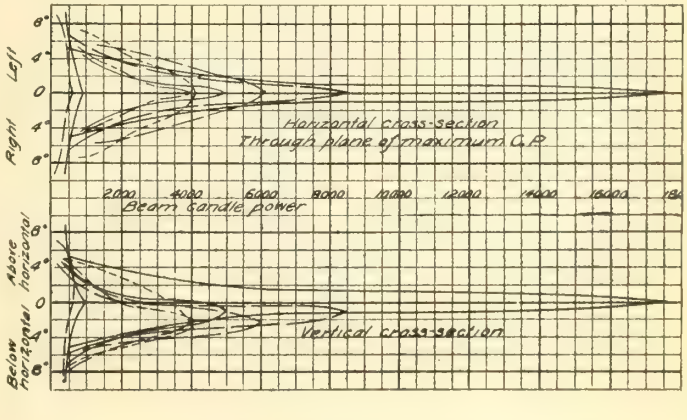


Fig. 7
Curves showing the horizontal and vertical cross-section of the beam from an automobile headlamp equipped with different types of glasses

for doing this but most of them make use of mirrors to direct the light from different angles from the units into the photometer axis. The one in use in this laboratory has two mirrors mounted at suitable angles on the one frame which can be rotated about the test unit so that candle power measurements can be made at different angles in the vertical plane. The distance from the light center of the unit to the photometric device is 10 feet, and the c. p. values are ex- pressed as apparent c. p. at 10 feet. The word apparent is used because the light from a large unit does not follow the

inverse square law at such a short distance. The 10 feet distance is commonly used in American laboratories.

In interpreting the results of tests the absorption of light by the mirrors must be taken into account. This may be done by calibrating the comparison lamp with the standard on the track and then in the distribution head and calculating the absorbtion from these results or by placing the standard directly in the distribution head and adjusting the voltage across the comparison lamp until a balance is obtained. The latter method requires a little less time. The most suitable method to use depends on whether a direct reading c. p. scale is used or the c. p. is obtained by reference to a table or by calculation.

It is common practise to make c. p. measurements at each 10 degrees around the unit. This method should not be blindly followed as some units change in c. p. so rapidly in some zones that very erratic results may be obtained. The curves in Fig. 9 show the effect of ¼ inch differences in the position of the light sources on the angle of the maximum c. p.

In summarizing the results of distribution tests the lumens in the principal zones are calculated for both the bare lamp and the lamp equipped.

Distribution tests of projector lamps have to be measured in a different way. A typical example is that of a series of tests on automobile head lamps we were called upon to make in connection with Ontario's head lamp law. A standard head lamp was set up so that it could be set to different angles in the horizontal and vertical planes and the beam was explored by means of an illumination photometer set up at the opposite end of the room. C. p. measurements were made at 0 deg., the center of the beam, 1 deg., 3 deg., 5 deg., 7 deg., 9 and 11 deg. from the vertical and horizontal axes Curves were plotted that show horizontal and vertical cross sections of the various beams, Fig. 7. To supplement these results the head lamp was set up on a table, fitted with castors, at the normal height from the road, (floor in this case) and the photometer was set up at a distance of 100 feet and the intervening distance marked off into 10 feet intervals. A reflecting test plate was used in this test and was placed on the floor and the photometer tube directed onto it. Foot candle measurements were made at each 10 feet mark by moving the head lamp up. These measurements gave the

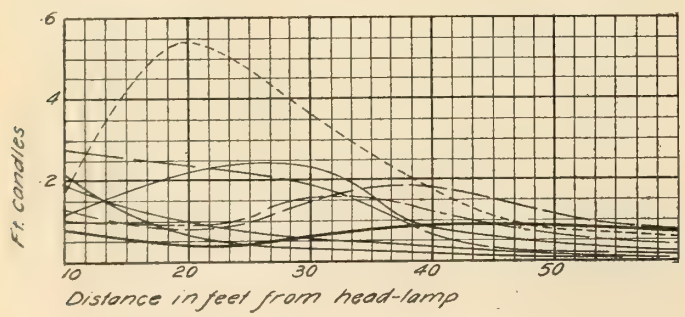


Fig. 8—Curves showing difference in road illumination from one automobile head lamp equipped with different types of glasses

road illumination from each lamp for the different glasses investigated. The curves serve as a check on the distribution curves, Fig. 8.

So far we have considered photometry in the laboratory. There is another very different branch that takes us out into streets, stores, offices, factories and anywhere where illumination is to be measured.

Of course work of this kind must be done with portable photometers. These photometers are usually built for a very wide range of work, such as measurements of c. p. in any direction, foot-candle and surface brightness. To make a survey of illumination the area selected should be representative of the conditions, as regards the surroundings, that prevail throughout the installation. The area is marked off into squares and a test station located at the center of each. In offices desk tops are 30 inches above the floor and measurements are usually made on this plane. In factories the bench height or machine height is the reference plane. Street lighting may be measured on the roadway or at some plane above it. There is no standardized method of making such surveys and much of the value of the test depends on the judgment of the one conducting it. Since the Commission started designing and installing street lighting our measurements have

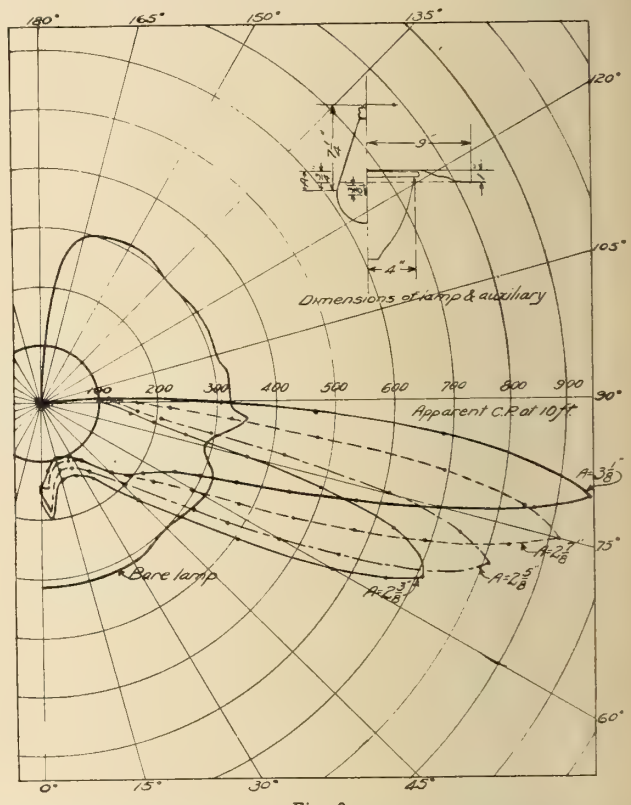


Fig. 9

Distribution curves of a gas-filled lamp equipped with a prismatic reflector. Different curves show the effect of different vertical positions of the lamp filament. An example of a case where a large number of candlepower measurements must be made to obtain the true distribution curve

been made on a plane 30 inches above the road. This has become a sort of standardized method with us to enable comparisons to be made. Sometimes vertical illuminations on an adjacent wall is required and in interiors the brightness of fixtures and the ceilings against which they are reviewed or the brightness of reflections from polished surfaces.

The Electric Club of Toronto

The regular Friday noon-day luncheons of the Electric Club of Toronto, were resumed Nov. 8 at the Prince George, the speaker being Mr. Alfred T. DeLury, Professor of Mathematics in the University of Toronto. Professor DeLury spoke on the subject, "On Keeping Step," enlarging upon the necessity of co-operation and a co-ordination of interests in the pursuit of any worthy end, just as the "tramp-tramp" of the soldier battalion is symbolic of the unified efficiency of the army. The speaker, however, warned against the possibility of carrying organizations and standardization to such an extreme as to crush individualism, and expressed the opinion that, in the end, more substantial progress would result by the free exercise of individual thought and free expression of that thought. As a teacher, he considered the most important function of his profession to be the training of men and women to think—to arouse in them the desire and curiosity to discover things and reach conclusions for themselves.

Hydro-Electric Reconstruction at Sherbrooke

The reconstruction work of the water power plants owned by the city of Sherbrooke, brought about interesting results, and a short review of the work done will show what can be accomplished in the way of raising the capacity of many an existing hydro-electric plant at a comparatively small outlay, and in some instances, as will be seen from this description, without interruption to plant operation.

The two corporation plants are situated on the Magog River. The Rock Forest plant is located at the outlet of Lake Magog, while the older plant of the two is located on Frontenac street, within the limits of the city of Sherbrooke. Both plants depend on the water storage of Lake Memphremagog, which is discharged at the rate of 550 cubic feet per second.

The total capacity of the two plants of the city of Sherbrooke, prior to reconstruction, was 2900 horsepower, as measured at the switchboard at the distributing point of the Frontenac Street station. The plants were rapidly approaching their ultimate capacity and the city of Sherbrooke decided to take steps to increase the capacity of these plants in order to enable them to cope with the demand from munition works.

A careful study was made of the hydro-electric equipment of the two power houses and tests were carried out to ascertain the performance of each machine, as well as the performance of each plant. With this information, the programme of reconstruction was laid out, aiming at the maximum amount of power obtainable under the highest possible commercial efficiency. The construction work was so planned as not to interfere with the operation of the plants except for one unit at a time.

In order to follow this work more readily, it will be well to give a brief description of the plants prior to the time of reconstruction.

Original Plant Equipment

The Rock Forest plant was built in 1911. This plant is some seven miles out of Sherbrooke. The power house equipment consists of two direct connected water-wheel generators of 940 kv.a. each, 3 phase, 60 cycle, 6,600 volt, operating at 180 r.p.m. The turbines are set in concrete open flumes. The maximum capacity of the two units under a head of 30 ft., was 2,200 h.p. at the Rock Forest switchboard. Two direct current water wheel driven generators of 50 kw. each are supplying excitation for the alternators.

The current of the Rock Forest plant is transmitted to the Frontenac Street plant, where it is stepped down to 2,200 volts for local distribution. The two power plants are operating in parallel.

The Frontenac street power house was built in 1908. It consisted of two direct connected water-wheel generators, of 25 kv.a. each, 3 phase, 60 cycle, 2,300 volt, operating at 225 r.p.m. The turbines were of horizontal type and were installed in steel cases. The combined maximum capacity of these units, under a head of 28 ft., was 1100 h.p. at the switchboard. A spare turbo-generator of 500 kw. was installed in the same plant, operating at 180 r.p.m. Two direct connected turbine driven exciters of 30 kw. each furnished the exciting current for the alternators.

The 6,600 volt transmission line connecting the plants consists of two 3-phase No. 1 B&S copper wire lines, carried on cedar poles and supported by Victor porcelain insulators No. 472.

After an examination and tests of the entire equipment, the following were the conclusions arrived at.

1st. The Rock Forest turbines were inadequate in capacity and inefficient.

2nd. The transmission line losses were too high and the line drop excessive for satisfactory operation.

3rd. The turbines at the Frontenac Street plant were of old design and inefficient.

4th. The crib dam at the Frontenac Street plant was wasteful of water.

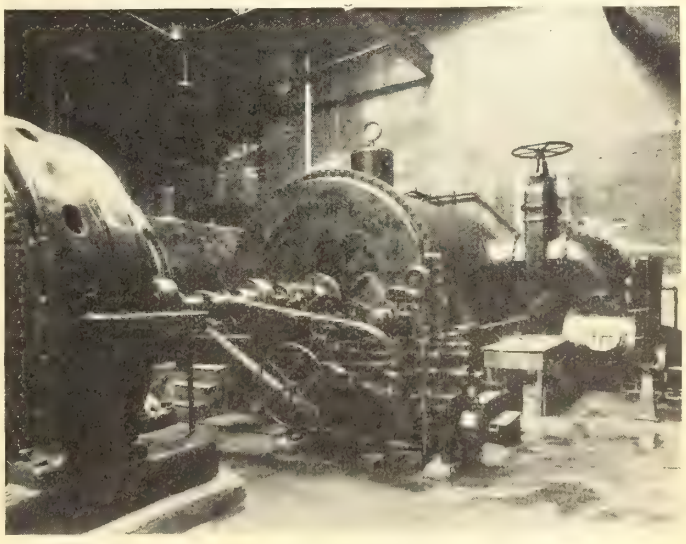
5th. The small turbines driving the exciters of the Frontenac Street plant were inefficient.

Reconstructed Plant.

While the Rock Forest plant was of modern design and construction, the maximum load the two units would develop at the switchboard at Rock Forest, was only 2,200 horsepower. In view of the local conditions not permitting of the realization of the full extent of power with the old turbines, it was decided to replace them in order to increase the capacity of this plant. As the Rock Forest plant has the advantage of the pondage of Lake Magog, which is approximately five square miles in area, the capacity of this plant was based on a load factor of 50 per cent.

The reconstructed units developed, under test, 3,000 horsepower at the switchboard, when operating jointly under a head of 30 feet. These turbines were furnished by the Morgan-Smith Company, of York, Pa.

The 940 kv.a. Canadian Westinghouse generators in this plant have done excellent service, when connected to the old turbines, and now with the considerably increased load, by the installation of the new turbines the same generators



Turbine and governor equipment, Frontenac St. Plant, Sherbrooke, Que.

carry the overloads under low power factor conditions in a most satisfactory manner.

The replacement of the twin, horizontal, centre discharge units was carried out in twenty days, with little inconvenience to power consumers, as by special arrangement enough water was discharged from Lake Memphemagog during this time, to permit of operating the spare 500 kw. generator at the Frontenac Street plant, which ordinarily would be out of service.

Attention was next given to the transmission line. The operating difficulties under a transmission voltage of 6,600 proved this voltage to be inadequate. The low power factor

at the load was responsible for an excessive drop, and at times the alternators were called upon to generate current at a voltage in excess of 8000. The investigation of the transmission line showed that a No. 472 Victor insulator was suitable for an operating voltage of 13,200.

The line is of triangular construction, with a spacing just sufficient to comply with standard requirements for 13,000 volts. It was found that the three Canadian Westinghouse, 533 kv.a. 6620-2200 volt transformers were built with standard 13,200 volt insulation, and could be operated with a grounded neutral. It was, therefore, decided that the current from the Rock Forest plant be transmitted at 13,200 volts and the installation of three step-up transformers at the Rock Forest plant was recommended.

With the installation of the three step-up transformers of 750 kv.a. each, at the Rock Forest plant, one line was placed in successful operation at 13,200 volts and the second line was operated at the lower voltage, pending the completion of work of reconstruction of a 6,600 volt substation of one of the power consumers, situated along the transmission line.

With both lines operating at the higher voltage, the saving in transmission will amount to 400 horsepower under the maximum conditions of power generated at the Rock Forest plant. Besides that, the voltage drop will be considerably minimized, thus resulting in an improvement in the power factor at the Rock Forest plant. The combined increase in power generated and transmitted over the two 13,200 volt. transmission lines, as measured at the switchboard at the receiving end of the Frontenac Street plant, is fully 50 per cent. over the power received at the distribution point before reconstruction.

The modifications to the plant at Frontenac street involved a considerable amount of work. As the city owned the right to develop 10 feet additional head on the Magog River, the new plans covered a 38 ft. development.

A concrete dam was built immediately downstream from the old crib dam. The dam is 285 feet long, with a maximum height from rock to stop log platform of 56 ft. The construction was carried on practically without interruption to the plant, except for a period of a few days. A great deal of concrete was placed in weather below zero with satisfactory results. To expedite the construction of the concrete dam, pneumatic placing of concrete was resorted to. The construction of the dam was carried out by Messrs. MacBean and Williams, of Montreal, and Mr. W. W. Plum was the contractor's engineer on the job.

As this plant is located between two privately owned plants without any pondage between them, a uniform flow of water is aimed at throughout the twenty-four hours a day. This restricted the capacity of the Frontenac Street plant. In order, however, to enable the plant to carry peak load fluctuations and to utilize occasional excess water, a load factor of approximately 70 per cent. was assumed, and the equipment was chosen on this basis.

The two old turbines developed, at full gate, when operating together, a maximum of 1,100 h.p. They were of an old type of construction, inefficient in the use of water and rather costly as to maintenance. As the steel cases and shafts were of liberal design, same were retained in order to permit of more rapid installation of the new units. The new units were supplied by the Boving Hydraulic & Engineering Company of Lindsay, Ont. The turbines are direct connected to 1,000 kv.a., 60 cycle, 3 phase, 2400 volt alternators, operating at 300 r.p.m. These machines are of Canadian General Electric make.

It was recommended, in view of the low power factor of the load, that the two 625 kv.a. generators of the old equipment be used after reconstruction as synchronous condensers for power factor correction.

The reconstruction of this plant proved very satisfactory. Tests of the two units, operating at the same time, show that they develop a maximum of 2500 h.p. at the switchboard, or 1400 h.p. more than the old plant developed with the same water. The increase is therefore, 127 per cent. in plant output. Minor modifications to a somewhat restricted tail race will allow of a further increase in the capacity of this plant. To permit the distribution switchboard to handle the increased load, the oil switches, current transformers, etc., were replaced with equipment of a larger rating. All instruments were recalibrated. Tirrill regulators were installed at both power houses to improve the voltage regulation of the system.

The excitation of the old units was furnished by means of 2 - 30 kv.a. turbine exciters. One of these turbines was taking the water from the steel case of the main unit, at a sacrifice of efficiency of the big turbine. In the new plant the excitation is furnished by 1 - 60 kw. generator, direct connected to an induction motor, with the result of a considerable improvement in the efficiency of the exciter set.

The work was carried out under the supervision of J. R. MacGregor, superintendent of plants, and E. Noel, superintendent of transmission and distribution. The concrete dam was designed by T. Tremblay, City Engineer, and the entire hydro-electric work was planned and executed under the direction of M. A. Sammett, consulting engineer, Montreal.

Pro Patria

Captain Chester William Halstead, M.C., of Ridgetown, Ont., was killed in action on October 10th last. Before enlisting, Mr. Halstead was manager at Ridgetown for the Bell Telephone Company. The official Gazette, in referring



The late Captain Halstead, M.C.

to his gallant work at Paschendale, which won him the Military Cross, said, "His utter disregard for machine-gun fire inspired his men greatly. He, with his platoon, captured 77 prisoners and two machine guns, the latter being brought into action at once against the enemy. After the captured position had been consolidated, he went forward some 200 yards, where he met an enemy staff officer, whom, on his refusal to surrender, he promptly killed. He gave a splendid example of courageous energy and dash."

The Dealer and Contractor

Are Contractor-Dealers Going to Stand Idly by and Watch the Hardware Stores and the Druggists Skim the Cream off the Electrical Milk Can?

A Provincial Hydro inspector dropped into a hardware store in his local town the other day and found the proprietor in conversation with a customer about a new fuse plug. The customer had blown a 10 ampere fuse and explained that this had happened a couple of times when his wife had connected up her iron. He didn't know the reason; there was no other load on his house at the same time.

"Oh," said the hardware man, "you need a larger fuse. This is 10—I'll give you a 20."

"Well, all right," replied the customer. I think there's a 30 on the other side though. Perhaps you'd better give me a 30 and make doubly sure."

"That's correct," said the hardware man. "We'll make sure with a 30."

And this is an age of "safety first"; at a time when rules and regulations covering installations, and the people making the installations, are supposed to have rendered the use of electricity fool-proof. The inspector naturally took occasion to "butt in," and explained to these two innocent babes that the trouble was doubtless due to a defective cord and that by increasing the size of the fuse they were merely adding to the chances for one more bad accident. As to rules and regulations governing the size of fuses to be used, the hardware man had never heard of them.

And this is no isolated case. Who is to blame that the merchandising of electrical goods of every sort has been, in effect, taken out of the hands of the electrical dealers and is handled very largely by hardware men, druggists, milliners and what not? The druggist's profession, for example, is safeguarded by law to prevent life hazards and yet these same people are allowed to handle equipment carrying as much hazard possibly as the average prescription, without the slightest protection to the public.

As long as the merchandising of electrical equipment is in the hands of uninformed retailers and salesmen, what is the use of making rules and regulations? All over the country these stores are the dumping ground for unapproved material, shoddy appliances of every sort that dishonor the whole class of labor-saving equipment to which they are supposed to belong and create a big life-hazard at the same time. Further, appliances of every sort and size are being sold for lamp socket connection.

Mr. Goodwin expressed himself as greatly disappointed with the number and type of electrical stores he found in Toronto. The same criticism holds to a greater or less degree, no doubt, all over the Dominion. Isn't the average contractor overlooking a golden opportunity? Think how well the two operations—wiring a home and then supplying that home with numerous electrical appliances—dovetail into one another. What home is there that, having cost $100 to wire, is not an immediate prospect for appliances totalling a much greater amount than this—electric fixtures, lamps, table lamps, iron, percolator, toaster, range, hot plate, vacuum cleaner, washing machine, and so on—and yet this large amount of business the contractor hands over to the hardware man with his compliments and the result is the hardware man makes a mess of the whole electrical business and muddles things up generally for the public, the inspection department, the contractors and the manufacturers.

The time has arrived when the merchandising of electrical appliances is as much a specialized business as is the sale of motors or transformers. Either the hardware man must inform himself of electrical matters or the contractor-dealers—who are already informed—must take it over. We must not forget that the hardware trade is well organized and is handled by men of intelligence who, if given half a chance will master the art of selling electrical goods. If contractor-dealers want to hold the field they must not delay very much longer.

The Establishing of Rigid Resale Prices Will Not Solve the Ills of the Electrical Industry—The Solution is Co-operation and Better Merchandising

A number of solutions have been offered for the difficulties besetting the path of the electrical contractor-dealer. The one most commonly mentioned is that manufacturers should establish resale prices on all the articles they make. This means that drastic measures would often have to be taken to enforce the maintenance of these prices, but contractor-dealers have frequently argued that manufacturers should refuse to sell to any dealer who did not hold to the price formally fixed on any article which he may carry in stock.

There can be no doubt that a measure of protection by the manufacturers and jobbers is due the dealer, but it does not appear that the arbitrary establishment of resale prices is the best form that protection can take. On the face of it, it is evident that one dealer can do business on a smaller profit than another and it constitutes an injustice, therefore, not only to the buying public, but to the dealers themselves, that the same fixed price should be charged in all localities and under all conditions. There is the other side of it, too, which we in Canada do not appear to have sufficiently considered, namely the legality of the proceeding. Can this practice be construed as a restraint of trade?

Right at the moment the whole matter is being thrashed out along this line in the United States courts. The Federal Trade Commission has just disposed of a case in which complaints were issued, charging violations of the law through fixing the resale price of articles, and an order to cease and desist from this practice has been issued in the case of Chester, Kent & Company, of Boston, manufacturers

of proprietary medicines. The order forbids the company to:

(a) Indicate to dealers the prices for which its proprietary or patent medicines shall be resold.

(b) Securing agreements from dealers to adhere to such prices.

(c) Refusing to sell to dealers who fail to adhere to such prices.

(d) Refusing to sell to dealers who fail to adhere to such prices upon the same terms as dealers who do so adhere.

(e) Furnishing any advantage to dealers who adhere to the resale prices, while refusing similar treatment to dealers who do not adhere to the prices.

This order of the Commission follows a similar decision of the Supreme Court of the United States in the case of the American Graphophone Company. The Federal Trade Commission has decided to issue complaints against all business concerns who refuse to sell unless the purchaser will agree to maintain a resale price fixed by the seller. It is claimed that when an article once passes from the maker to the purchaser, the latter owns it and may sell it at any price he chooses, so long as that price is not below cost, in which case he would be entering into unfair competition with other retailers selling the same article.

It is evident, therefore, that so far as the United States is concerned—and there is little doubt conditions are identical in Canada—the establishment of fixed resale prices will not solve the difficulty the contractor-dealer is meeting in the way of making a living profit. The solution lies rather in better merchandising methods, a closer study of the conditions under which each is operating and a better co-operation between the dealers themselves, first, and the manufacturers, jobbers and contractor-dealers, second. We are too apt to take it for granted that the cause of failure in business is too low a resale price. This is very rarely the case. Poor business methods in the retail business are almost universal, and this, we believe, is the direction along which education must proceed before the general condition of electrical merchandising, in Canada, is placed on a satisfactory and stable basis.

Those Who Pass and Those Who Pause—Which Kind of Window is Yours?

If there is any doubt in your mind as to whether it pays to spend a little time in making your windows attractive try this test yourself. Station someone outside your window with instructions to count the people who pass your store, and those who pass in front of your window. Then change the trim, making a special effort to produce an interesting display, and try the same plan.

Unless your experience is an exception you'll find that the well-planned, carefully trimmed window will attract a considerably higher percentage than the window jumbled together in a hurry some Monday morning. Care and thought in window trimming always pay.

You may learn some things about color and motion and arrangement from this single test that will help you in every window you trim.

But remember this when you look over the tally sheet of people who pass and people who pause: The figures are only an indication of the value of a trim as an effective sales factor.

Two windows, for example, might draw equal crowds, yet one would merely satisfy idle curiosity, while the other would actually sell goods. The important thing to remember is to put sales interest into the trim. The nearer you can bring your message home to the passer-by the more effective is the trim.

Don't forget that the window space is the most valuable part of your store. Make the most of it.

Change your trim often. Keep up with the times. Try to have the most attractive window, not only on your street, but in your whole city. Don't think for a minute that your chance is limited by the size of your window, for it isn't true. Small windows frequently are better trimmed than those which can show a half block of plate glass.

The effectiveness of your window depends solely upon the plan and its execution—and both depend on you.

Notice re Meter Loops

The Chief Inspector of the Toronto Hydro-electric System has asked the attention of electrical contractors to the need of allowing sufficient length on meter loops for power services. Each single wire should not be less than eighteen inches in length.

New Book

Central Station List—published by the McGraw-Hill Book Company, Inc., 10th Avenue and 36th Street, New York. This book contains a list of central stations in Canada and the United States by states, provinces and cities; statistics showing the total number of private and municipal plants, companies selling appliances, companies having day service, and other data; towns with a population under 1,000 getting current elsewhere; state and provincial commissions having jurisdiction over electric light and power utilities; index to central stations whose names do not indicate their location. Price $15.00.

Trade Publications

Condulets.—Suggestion No. 33, by the Crouse Hinds Company of Canada; describing an actual installation of weatherproof outlets and fittings.

C.G.E. Publications.—Bulletin 40021, describing belted direct-current generators, Type LF, and Bulletin 48940, describing constant energy arc welding sets for metallic electrodes—both well illustrated.

Switches.—Catalogue No. W-38, by the Square D Company; describing Square D switches of the steel-enclosed and iron-enclosed types; also motor starters, compensator type switches, plug receptacles, meter protective trims and accessories; illustrated.

It is to be hoped that dealers in electrical equipment will not fall behind in the movement evidenced in the other lines of retailing to get the Christmas shopping campaign well under way during the present month. The average citizen has caught the spirit of conservation underlying this programme and is doing his shopping a month or six weeks earlier than usual. If the electrical dealer delays his advertising propaganda, he will undoubtedly lose the trade which the excellence and utilitarianism of his produce justifies him to expect in this holiday season. The Christmas stock should be displayed at once, windows dressed with holiday goods and the spirit of Christmas injected into the advertising, so that people may know that electrical stores are alive to the newer conditions under which we are now living.

3-Wire D-5 Meters

At the present time when great attention is being given to conservation and standardization, the new direct current, 3-wire, service watt-hour meter just placed on the market by the Sangamo Electric Company is attracting attention. This meter consists simply of two standard 2-wire elements placed side by side in a common base and registering their kw.h. on a common recording train so that the sum of the revolutions of the two elements will be properly added and indicated on the kw.h. dial of the meter. This is effected by means of a very simple but ingenious differential gearing within the recording train so that no matter what load there may be on one element as compared with the other, the total revolutions of the two elements will be accurately added and recorded. Even with one element fully loaded and the other one without load, the registration is as accurate as though each element were recording on a separate train. This arrangement of meter elements and train is not new, but has been given a thorough and successful test on similar ampere-hour meters built for use with storage batteries on submarine vessels of the U. S. Navy, during the past two years. The only difference between these very successful ampere-hour meters for submarines and the present 3-wire D-5 service type meter, is in the fact that the driving elements in the ampere-hour meters have permanent magnet fields instead of shunt energized fields of the watt-hour meter.

As will be seen from Fig. 2, each element of the new 3-wire meter is a standard 2-wire element including the light

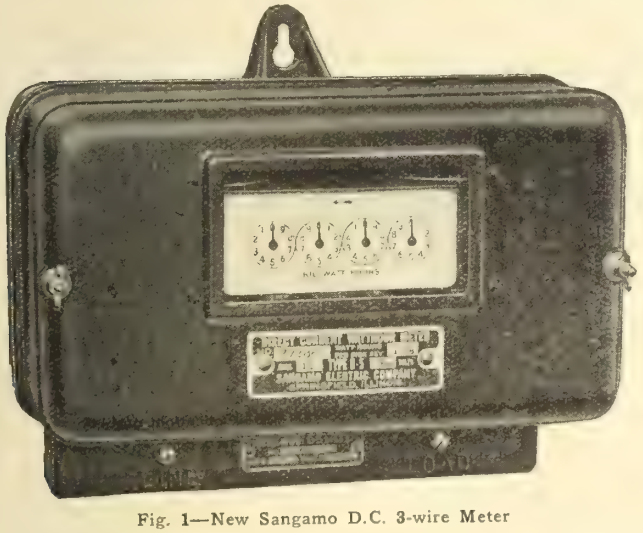


Fig. 1—New Sangamo D.C. 3-wire Meter

load adjustment, the arrangement of damping magnates, and in the case of meters over 10 amperes capacity, the arrangement of internal or external shunts. As shown in diagram Fig. 3 and from the arrangements of the elements it will be apparent that this meter achieves the requirements of a true 3-wire direct current meter; that is, one which will measure and record accurately the load on either side of a 3-wire distributing system, no matter whether the other side is entirely dead. For example, if the fuse in one outer line of the system is blown or purposely withdrawn, the element connected in the other side will record accurately the load on that side, as its potential circuit and measuring circuits are independent of the side which is open. If the neutral fuse is blown or withdrawn, the two potential elements remain in series across the outer lines so that the meter will continue to record any load that may pass through it between the outer wires with the neutral open. Under widely unbalanced conditions of voltage between the outer lines, this meter will record with a degree of accuracy which it is claimed is impossible with any former 3-wire direct current meter having a single potential element connected either between one outer line and the neutral, or between the two outer wires. As shown in the diagram, the elements are so connected through an interchange of connections within the terminal box itself that the load wires, from and to the line, pass in and out of

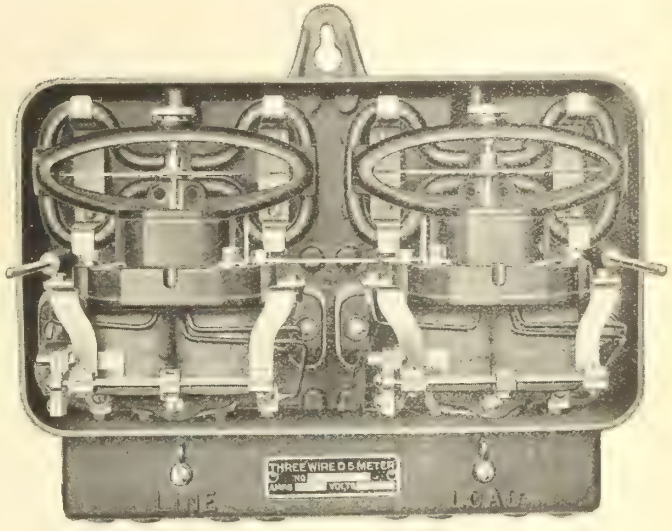


Fig. 2—Meter with case and recording train removed, showing two independent standard 2-wire motor elements

the meter in regular succession; no crossing over of interchanging of leads being required. The recording train is held on a bracket connecting the two motor elements, shown in Fig. 2 with the train removed, and absolutely correct meshing of the two worm wheels on the train, engaging with the two elements, is obtained by a system of locating rear bearings of the worm wheels similar to that used in the standard 2-wire meter. The train is held in position by a

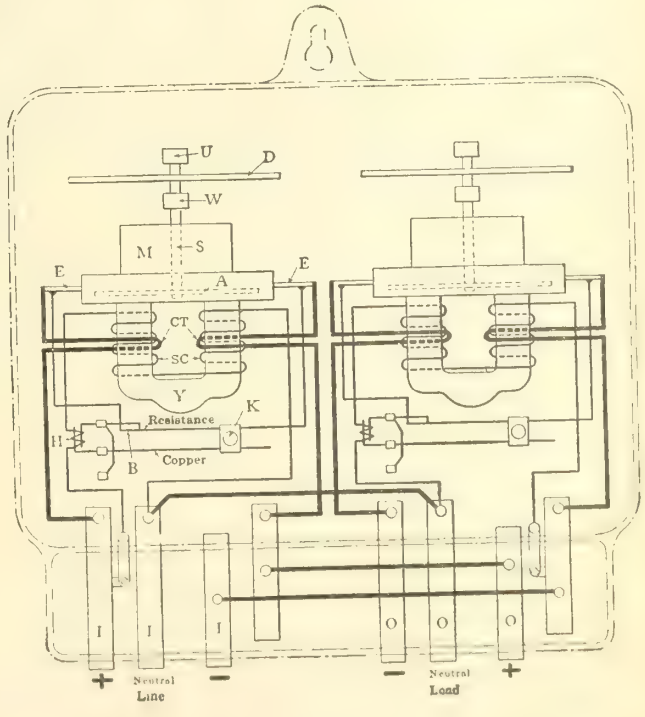


Fig. 3—Wiring diagram showing internal connections of the new Sangamo 3-wire D.C. Meter

simple device operated from the top front so that it may be readily removed for purpose of inspection and calibration of the elements. In calibrating, each element is considered and tested as a standard 2-wire meter without respect to the other element. For this reason, an absolutely perfect balance of

the two elements may be secured in minimum time and effort by the tester.

The meter when connected, occupies about the same space on the wall as an ordinary polyphase service type alternating current meter. This meter will be supplied in all capacities from the unshunted 10 ampere meter, to the largest externally shunted capacities.

The Walger Insulated Wire Connector

The Walger insulated wire connector is illustrated herewith. This is a device for fixture outlets and motor leads, which does away with blow torch, alcohol, acid, solder, rubber tape and paste, and allows the operation of making connections with a considerable economy in time. All you require to make the connection secure is a screwdriver. It is argued by the manufacturers of this device that an electrician can leave the workshop with enough connectors in his pocket to wire up the fixtures of a whole house; that he can do the work in a fifth the time, and always have clean hands to



The Connector

handle the fixtures; that the device facilitates the exchange of fixtures and that it can be used without difficulty in places where the electrician is cramped for room. It is also claimed that a piece of work on which these connectors have been used exclusively can be examined by the inspector more readily and more thoroughly and that as a result the many fires attributed to defective wiring may be greatly reduced by their use. The illustrations show the method of making



The Insulating Shell

the connection and also the insulating shell and cap that covers each connector. The device is approved by the Underwriters' Laboratories, of Chicago, and by the Hydro-electric Power Commission of Ontario. It is being handled by Mr. C. Jackson, 22 College Street, Toronto.

Personals

Mr. John S. MacLean, advertising manager of the Canadian General Electric Company, and also of the Canadian Allis-Chalmers Company, for the past five years, has resigned.

Lieut. M. B. Hastings, secretary, A. H. Winter-Joyner, Limited, Toronto, has been awarded the Military Cross. Lieut. Hastings left Canada with the 4th Canadian Mounted Rifles Batallion, but was later transferred to an artillery company.

Obituary

In our last issue we recorded the appointment of Mr. H. E. Randall, of the Shawinigan Water and Power Company as sales agent of the Ludlum Electric Furnace Corporation, N.Y., and his serious illness from influenza. We regret to report that the illness terminated fatally, the electrical profession thus losing one of its younger and most promising members. Consequent on Mr. Randall's death, Mr. R. J. Beaumont has been appointed manager of subsidiary companies, and Mr. P. R. Labelle power sales manager of the Shawinigan Water & Power Company.

Current News and Notes

Estevan, Sask.

A proposal is on foot to build a plant at Estevan, Sask., for the supply of light and power to the cities of Weyburn, Regina, Moose Jaw and intervening points. It is believed that such a plant could be made a commercial success by the use of lignite fuel. Reports state that local opinion is decidedly in favor and that steps will be taken immediately to secure the necessary funds.

Eyebrow, Sask.

Messrs. Carlyle & Seeley, of Eyebrow, Sask., are planning the installation of an electric lighting plant to light the business section of the town. While the matter has not been definitely decided, it is thought the plant will be designed for 15 kw., 110 volt, direct current operation, the motive power to be a 30 h.p. oil engine.

London, Ont.

Manufacturers in London, Ont., have been asked to run their factories on daylight saving time during the winter as a measure of combatting the power shortage.

The London Hydro-electric System completed the first ten months of the fiscal year with a surplus of $68,000 over all operating and capital costs.

Moose Jaw, Sask.

High operating costs are said to have brought about a crisis in the affairs of the Moose Jaw Street Railway, a privately owned system. Unless some immediate relief is forthcoming it may be necessary for the company to cease operating.

Quebec, Que.

Quebec city authorities have joined in the movement to protest against the increased rates announced by the Bell Telephone Company.

Regina, Sask.

The recent increase to the straight five-cent fare on the Regina Street Railway is, according to a recent statement, responsible for an increase of $20,000 in revenue for the first ten months of the year. Approximately the same number of passengers were carried.

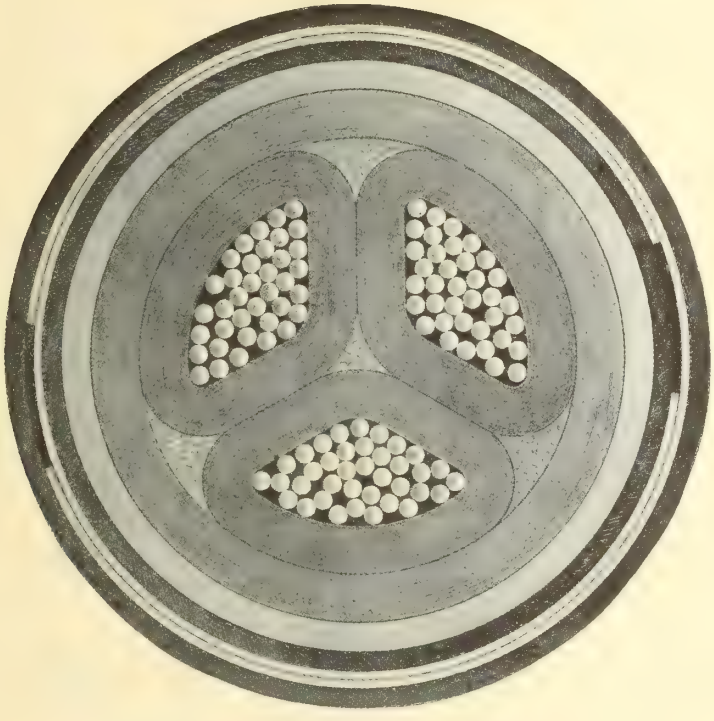
Toronto, Ont.

In a report recently submitted by auditors appointed to go over the books of the Ontario Hydro-electric Commission, it is shown that the total assets of the Commission amount to $28,950,803. Under this heading is included an asset of $15,070,307, representing the value of the Niagara system and the seven secondary systems in the province. On the other side of the ledger are cash advances by the province amounting to $17,037,074 on the various systems; $1,200,000 on Niagara power development; $583,131, due Central Ontario System; debentures re purchase of Ontario Power Company, $7,984,000. Other debentures total $51,216; accounts payable $27,443. The liabilities also include reserves for sinking fund aggregating $238,531, and reserves for renewals contributed by municipalities and in respect of service and office buildings amounting to $1,139,258. There is a reserve of $137,701 for contingencies and the Commission owes to municipalities in respect of operating surpluses, $446,484. Another surplus is $83,509 arising from departmental operations in the service building. An insurance reserve of $2,451 completes the liabilities.

Wapella, Sask.

Mr. W. P. MacDonald, of Wapella, Sask., is planning the installation of an electric lighting plant and is calling tenders for a dynamo, engine, wire and general equipment.

POWER CABLE



350,000 C.M. 3-Conductor 12000 volt
Paper Insulated, Steel Tape Armoured Cable

Overall Diameter—3.62 ins.

Built to Specifications of Hydro-Electric Power Commission of Ontario

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Eugene F. Phillips Electrical Works, Limited
MONTREAL

Branches: Toronto, Winnipeg, Regina, Calgary, Vancouver

FOR SALE

[illegible] alternators, from 25 KW to 900 KW, 25 and 60 cycles. Located in Canada.

CHARLES J. EACOCK,
107 Duke Street, Toronto.
[illegible] 3227 21-22

Alternator Wanted

250 to 350 KVA alternator, 2300 volts, 3 phase, [illegible] cycles, revolving field, 2 bearing, for direct [illegible] to water wheel; speed from 200 to 300 R.P.M. Apply Box 806, Electrical News, [illegible] Ont. 21-22

Transformers

FOR IMMEDIATE DELIVERY

25 Cycle Single Phase

5	300	KVA	2200 to 575	Volts.
3	50	KVA	2200 to 550	Volts.
3	40	KVA	2200 to 550	Volts.
6	7½	KVA	2200 to 550	Volts.
2—	15	KVA.	2200 to 220/110	Volts.
3—	7½	KVA.	2200 to 220/110	Volts.
4—	5	KVA.	2200 to 220/110	Volts.
2—	3	KVA.	2200 to 220/110	Volts.
1—	2	KVA.	2200 to 220/110	Volts.

These transformers were built by The Canadian Crocker-Wheeler Co., Ltd., and are in first class condition, some of them never having been used. They were bought before prices advanced so can be disposed of at attractive prices.

O'BRIEN & DOHENY,
Thorold, Ontario.
22-22

An electric pumping installation, completed about June 1, at Sidd's Landing on the Sacramento river, in California, made practicable the irrigation of 23,000 acres of rice land during the past season, the value of the product this year being estimated at $4,300,000. The product is that of the Provident Irrigation District, which spent $750,000 on its pumping plant and system of irrigating canals. This body of land, formerly considered worth $30 per acre, is now valued at $150 per acre.

The pumping equipment consits of four General Electric 500-hp., 2200-volt motors, direct-connected by flexible couplings to four Byron Jackson 42-in. horizontally split, double-suction pumps of a combined capacity of 220,000 g.p.m., against a head of 30 ft. Electric energy is supplied by the Northern California Power Co. The power required in pumping water for the tract of 23,000 acres cost about $35,000 for the irrigating season of five months.

The U. S. Council of National Defense makes this statement in a circular letter sent to the several State Councils of Defense:

"Housing and war work are vitally connected. A man who raises crops, turns shells, or builds ships must have a place in which to live. His health and efficiency are directly dependent upon housing conditions. Adequate and satisfactory housing is thus one of the outstanding needs of the day."

PETRIE'S LIST

of New and Used

MOTORS

FOR IMMEDIATE DELIVERY

No.	H.P.	Phase	Cycle	Volts	Speed	Maker
1	100	3	25	550	480	Westg.
1	30	2	60	220	1500	T. & H.
1	25	2	60	220	945	Westg.
1	20	3	25	550	1440	J. & M.
3	15	3	25	550	730	Westg.
1	10	3	25	550	1400	Lancashire
1	10	3	25	550	720	Westg.
1	7½	3	25	550	1500	Lang.-Dav.
1	7½	3	25	550	750	C. G. E.
1	6	2	66	220	1200	T. & H.
3	5	3	25	550	720	Westg.
5	4	3	25	550	1400	Excelsior
2	3	3	25	550	1500	C. G. E.
3	3	3	25	550	1400	Excelsior
1	1	3	25	550	1400	Excelsior

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Rubber Covered Wires and Cables

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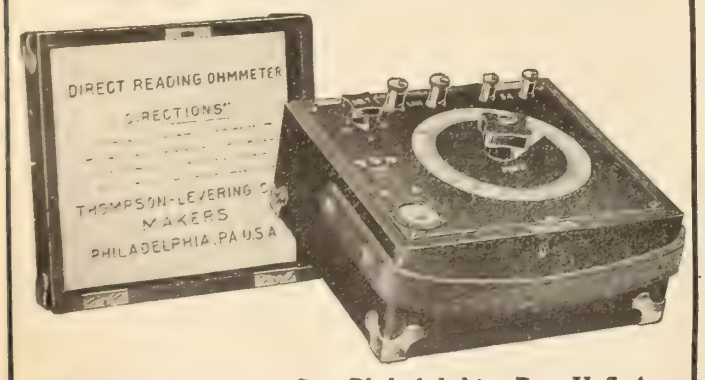
Incandescent Lamp Cord, Flexible Switchboard Cables, Special Cords and Cables for all kinds of Electrical Work.

Prompt Shipments from Canadian Factory.

BOSTON INSULATED WIRE & CABLE CO., Limited

Canadian Office and Factory, HAMILTON, ONT.

DIRECT READING OHMMETERS



Thompson-Levering Co., Philadelphia, Pa., U.S.A.

Tenders

A few dollars spent in advertising your proposals in

The Contract Record

would result in additional competition, which might save your city or town or your client many hundreds of dollars.



In Stock for Immediate Delivery

Turbo-Generator Units
Direct Connected Units
Motor Generators
Rotary Converters
Transformers
Boilers
Smoke Stacks
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Separate Published Stock Lists for above apparatus.

Staff of Engineering Specialists with three overhauling plants to SOLVE YOUR POWER PROBLEMS.

MacGovern & Company, Inc.

285 Beaver Hall Hill, Montreal

Offices: New York, Pittsburg, St. Louis

Plants: Brooklyn, N.Y., Lincoln, N.J., and Linden, N.J.

BUYERS AND SELLERS OF
NEW AND USED MACHINERY

A Continent-wide Service

List of Motors

No.	H.P.	Phase	Speed	Volts	Cycles	Starter	Make
1	15	3	1500	550	25	yes	T.H.E.
1	50	3	750	550	25	yes	C.G.E.
1	60	3	750	550	25	yes	Crocker Wheeler
2	50	3	750	220	25	yes	Lincoln
1	25	3	750	220	25	yes	Lincoln
1	25	3	750	220	25	yes	C.G.E.
1	10	3	1500	220	25	yes	T.H.E.
1	3	3	1500	220	25	yes	Westg. CCL.
1	½	1	1800	110	60	no	Fort Wayne
1	¼	1	1800	110	60	no	Westgh.
1	¼	1	1800	110	60	no	Fisher
1	40	2	900	220	60	yes	Fuller Wenstrom
1	15	2	1800	220	60	no	T.H.E.
2	5	2 or 3	1800		60	no	Westgh. CCL. rewd.
2	1	2 or 3	1800		60	no	Westgh. CCL. rewd.
1	½	2	1800	220	60	no	Westgh. CCL.
2	10	2 or 3	1200		60	no	Westgh. CCL. rewd.
1	5		1200	220	60	no	Union (New)
2	3	3	1800	220	60	no	C.G.E. rewound
4	7½	3	1800	220	60	yes	Lincoln

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Solderless Connection



Insulating Shell and Cap



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All you require to make the connection secure is a screwdriver.

The Walger Insulated Connector is so simple in construction that it is impossible to make a mistake in making a connection. In other words, it is wonderfully simple and simply wonderful when you see it in use.

The Walger Insulated Connector is one of the most profitable electrical accessories you can handle. Write for further information.

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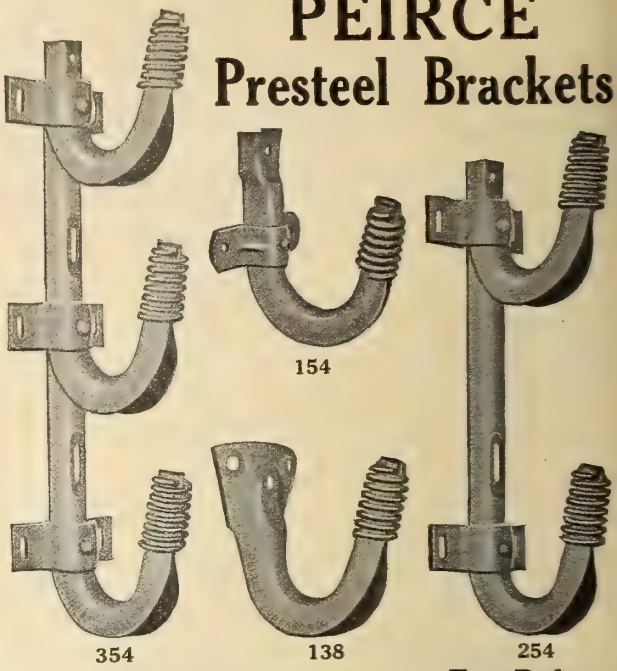
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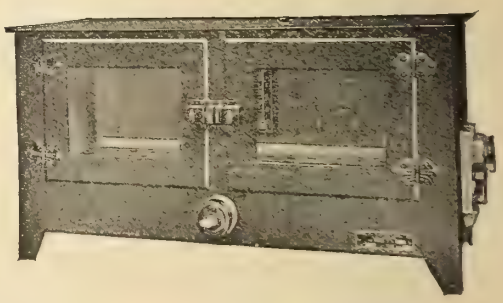
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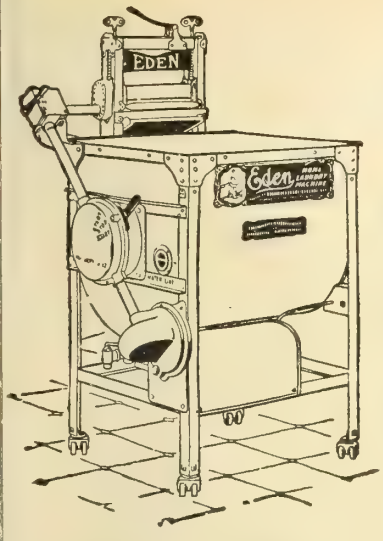
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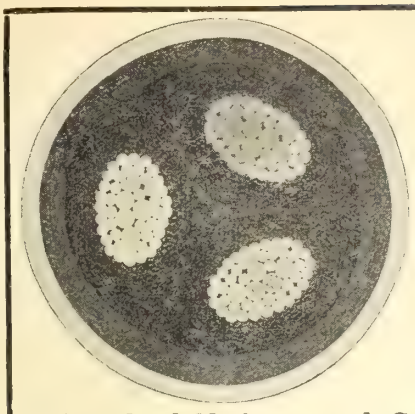
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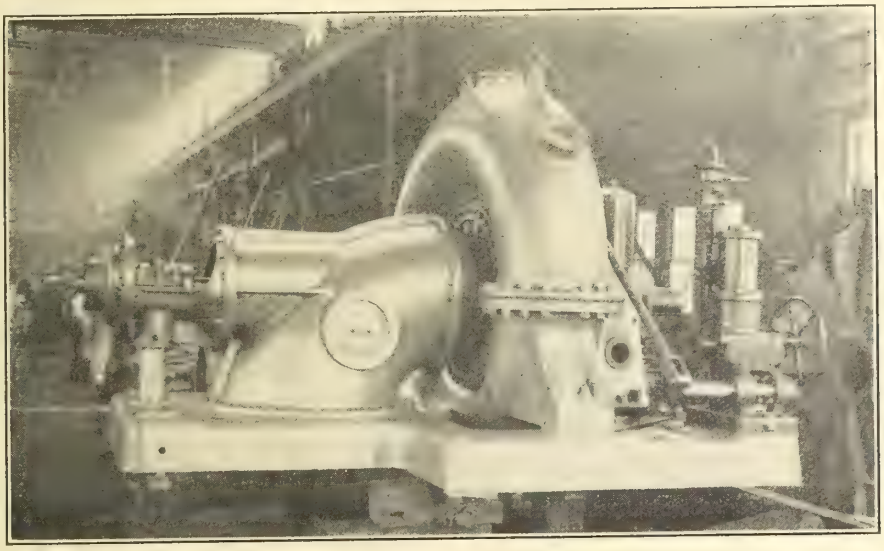
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(Continued on Page 56)

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The success of our armies depends on maximum industrial production. The elimination of accidents is a powerful factor in production. And accidents cannot be avoided so long as open knife switches are used. If those in your plant have not been replaced with Square D Switches, why not? Ask your Electrician.

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do not hinder production

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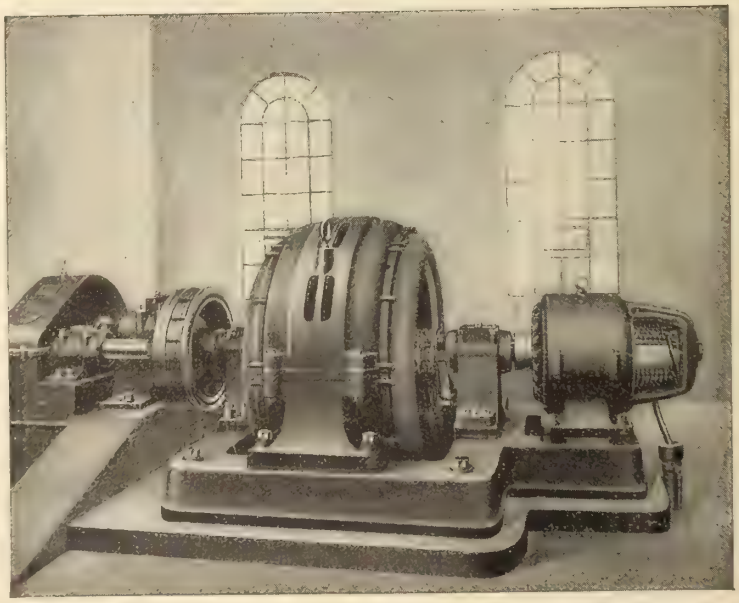
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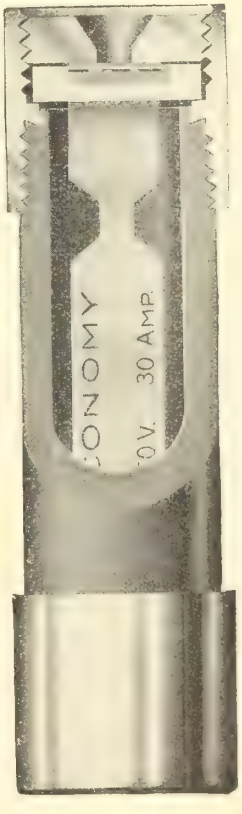
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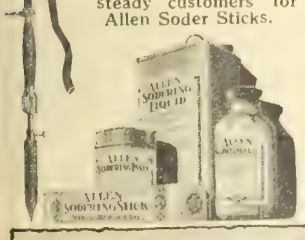
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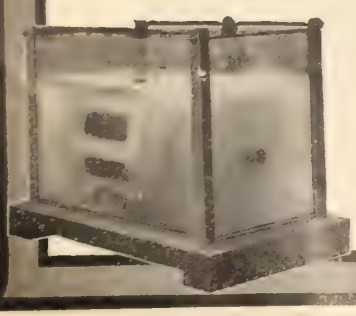
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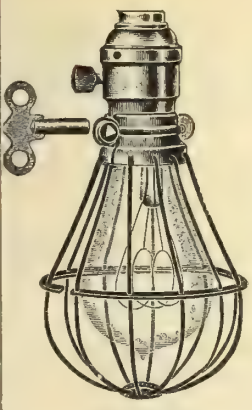
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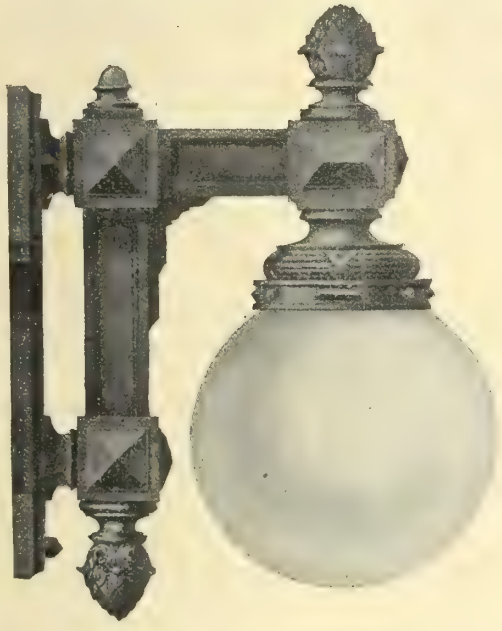
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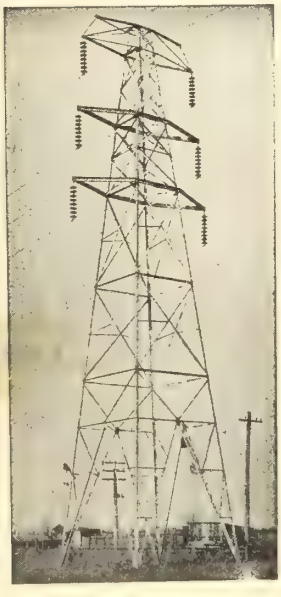
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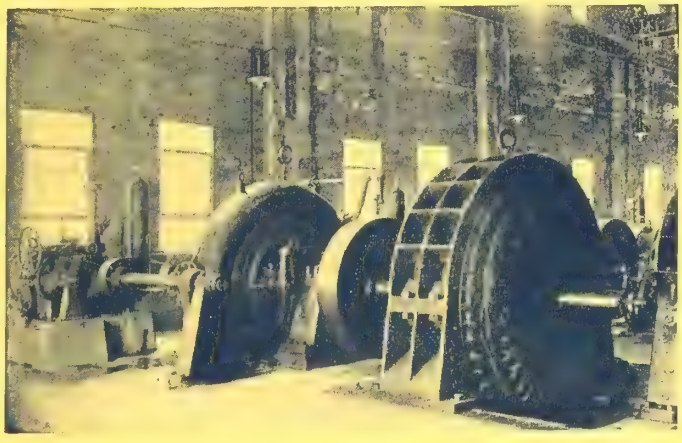
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How much have YOU lost in prestige through not being able to take care of your customers' business?

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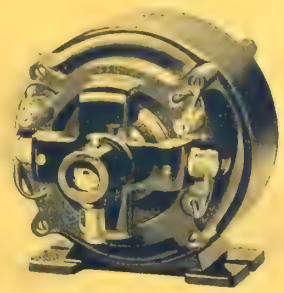
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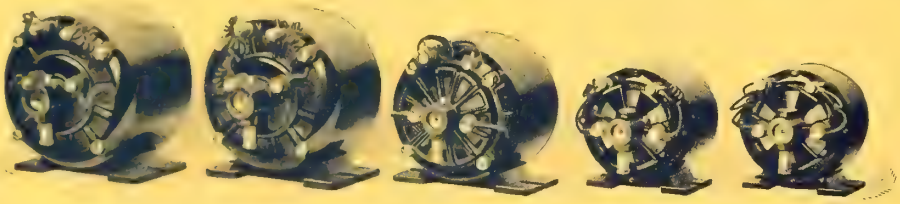
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1/10	1500	A-2	Tic	38
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For 220 volt add "LY" to code.

Prices for any voltage upon request.

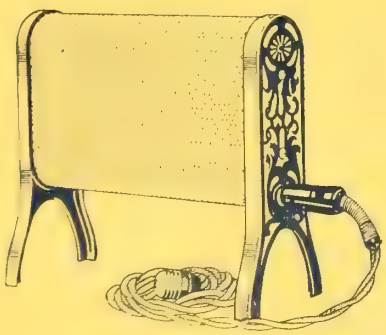
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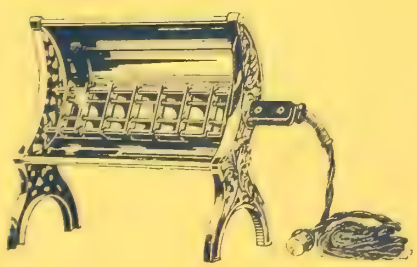
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Electrical News
Generation, Transmission and Application of Electricity



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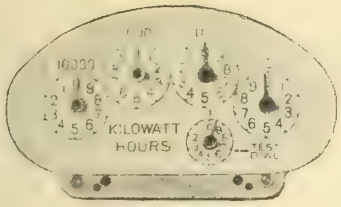
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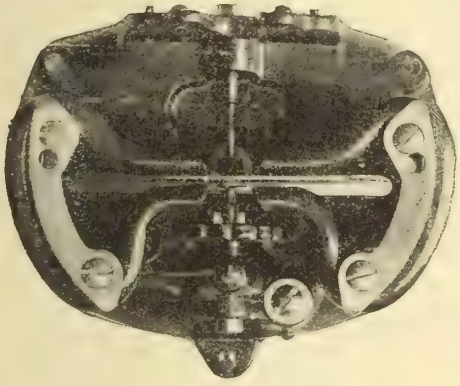
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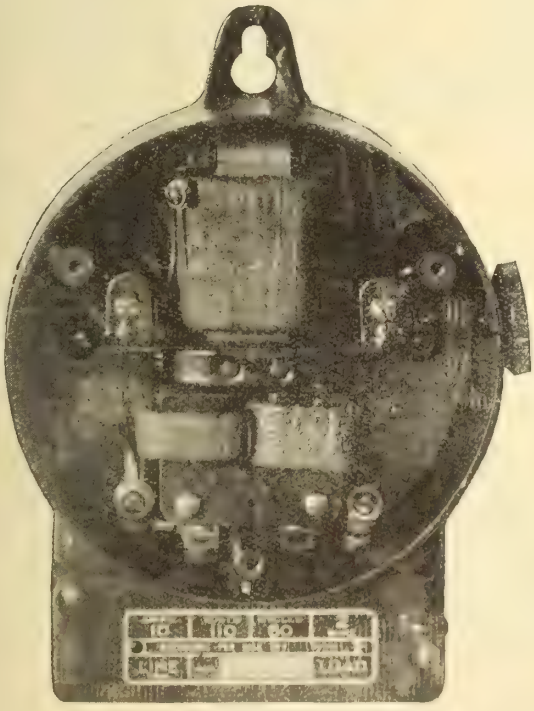
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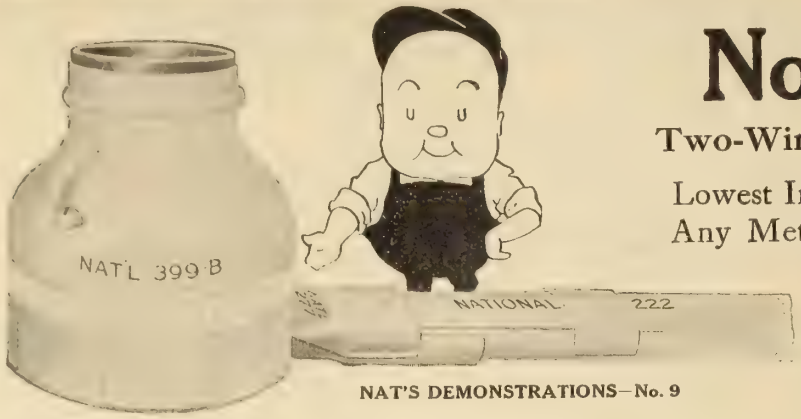
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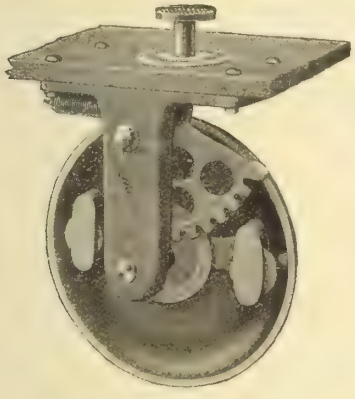
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With these signs destination names can easily be changed and cars rerouted. Well labeled cars make more money.



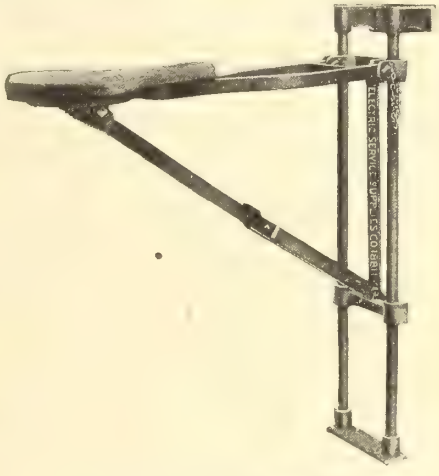
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A louder gong and more continuous to meet requirements resulting from modern, heavy, noisy traffic in cities.



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To light your cars scientifically, efficiently and safely. To save you money.



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For the motorman or conductor. A real collapsible, safe and durable seat. They make operators more contented.



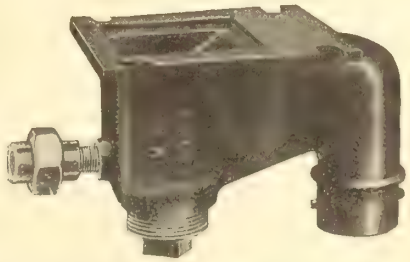
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To light up a path to safety for your cars. Only their famous reflectors can project the distinctive "Golden Glow" light.



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To protect your overhead construction from "flying" poles thus preventing delays and tie-ups.



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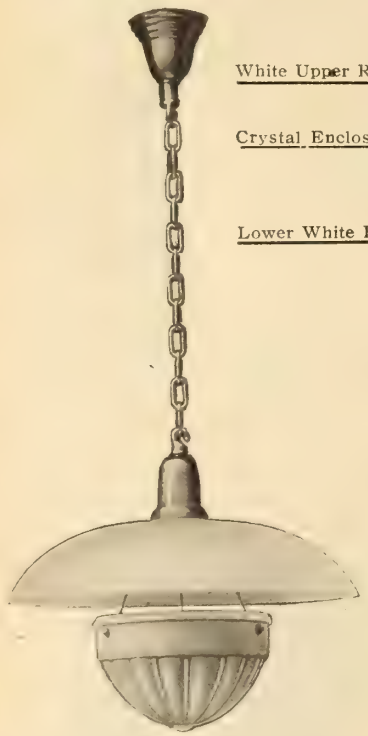
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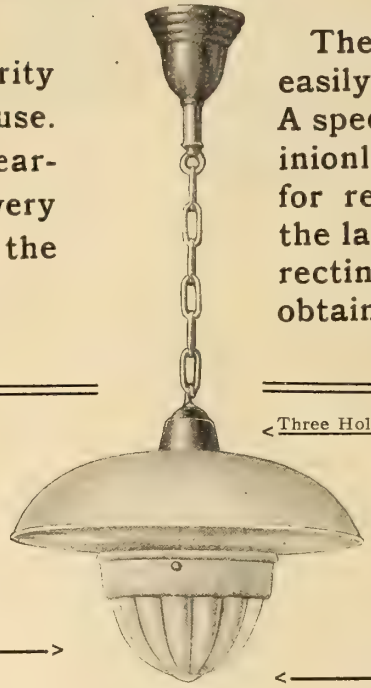
MONTREAL Lyman Tube Bldg.
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TORONTO 33 Melinda St

"Dominionlite" Nitrogen Units

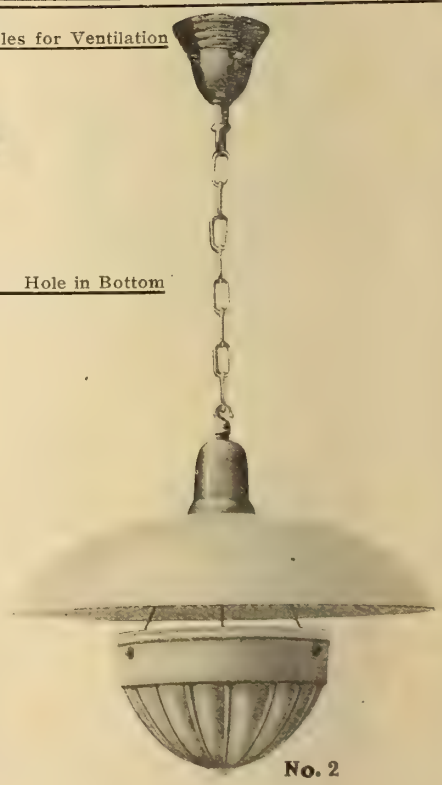
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They are made to lift apart easily to facilitate cleaning. A special feature of the "Dominionlite" is the adjustment for regulating the height of the lamp inside the globe, directing the light rays so as to obtain the highest efficiency.





No. 3



No. 2

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"LUMO"
Glass Throughout

No. 1

Made in Canada by

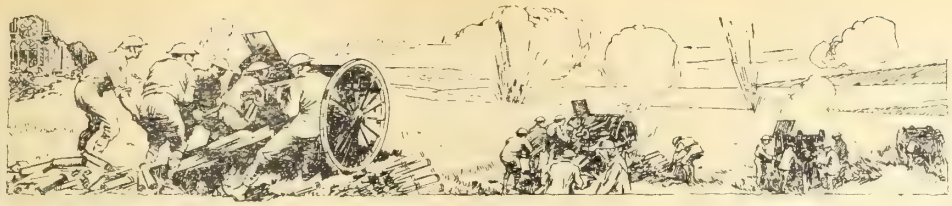
Jefferson Glass Co., Limited

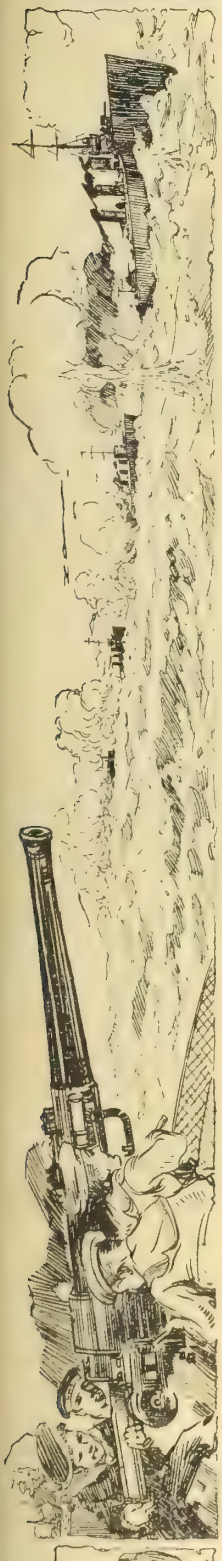
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325 Howe Street




The Needs of the Empire

NEVER BEFORE in the history of Canada has greater opportunity been offered her Sons and Daughters to render SERVICE to the Empire;—and

NEVER BEFORE have the needs of the Empire demanded as high a standard of QUALITY in thought, deed and product as at present.

HOW NOBLY CANADA has responded is now known around the World and history will record it for the future.

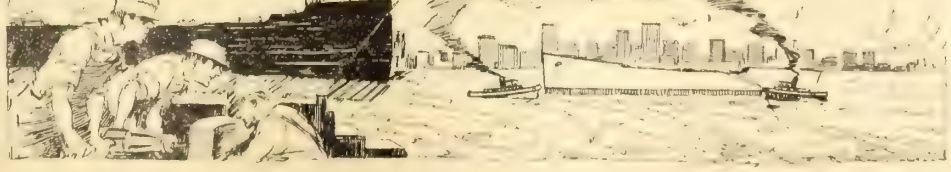
THE PRODUCTS OF OUR MILLS are at the Fronts and on the Seas, in the Shipyards and Factories and in the Fields, faithfully fulfilling their mission of reliable performance wherever the Government's War-Winning Programme directs, as we are, and have been, stripped for action since the first call to arms.

THE NEEDS OF THE EMPIRE are many and the War-Winning Programme changes as necessity demands; but it matters not, the needs of the Empire are paramount and must be supplied.

THEREFORE, if in these trying times, we do not deliver promptly to you such of the products of our Mills or Blast Furnaces as you may need, console yourself with the thought that through us, you are rendering Service to the Empire and to the Cause that matters most for the Liberty, Justice and Freedom of the World.

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Useful in the Shop and Laboratory for the Measurement of Resistance Adapted for Fault Locations in Telegraph and Telephone Lines and Cables.

The Type S Bridge is a thoroughly practical instrument for shop and field use. Being complete in every detail it is ready at all times for immediate use. It is easily portable, its weight being but 8 pounds. The precision of adjustment of its coils (Rheostat 1/10 per cent., Ratio 1/20 per cent.) insures accurate measurements. The galvanometer, the weakest element of such an instrument, is unusually rugged. It is a separate element and may be removed for examination or repair by taking out two screws. The battery is of the ordinary "flash light" type, and renewals may be procured practically everywhere. The price is $66.25 net, f.o.b. Philadelphia, boxed for shipment.

Bulletin No. 530 describes this instrument.

THE LEEDS & NORTHRUP CO.

Electrical Measuring Instruments

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A "Galvaduct" Building

"GALVADUCT" and "LORICATED"

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The most perfect interior construction conduit on the market.

Recognized as the standard of high quality.

Always specify Galvaduct or Loricated CONDUITS

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A high-class interior construction conduit of the enamelled type, proof against acid or other corrosive agents.

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Packard SERVICE TRANSFORMERS

Coils Impregnated by Vacuum Process

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Mica Barriers

Strong Rugged Durable



Steel Cases

Light in Weight

Easy to Handle

Will Not Leak

Unsurpassed Appearance

Operating Characteristics The Best

WELDED STEEL CASES

We Build Large Power Transformers
Special Furnace Transformers
Current and Potential Transformers

THE PACKARD ELECTRIC CO., Ltd.

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Marchand Clamps are the safest and most efficient Wire Clamps on the market.

Marchand Clamps are easily and quickly installed and save labor and material.

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Marchand Clamps cannot wear out or break and have been thoroughly tested and will not rust.

WRITE FOR COMPLETE CATALOG No. 33

STEEL CITY ELECTRIC COMPANY
"The Quality Line"
PITTSBURGH, - - PENN., U. S. A.

"KILLARK" ENCLOSED FUSES 600 VOLT

NATIONAL ELECTRICAL CODE STANDARD TO 400 AMPERES, INCLUSIVE



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Note That—The Cheapest STORAGE BATTERIES

are those made by the Canadian Hart Accumulator Company at St. Johns, Quebec.

Save at least 35 per cent. customs duties on Storage Batteries for every purpose. For lighting Farms, Towns, Country Houses, or for Electric Trucks,

May We Quote ? Our Prices to You

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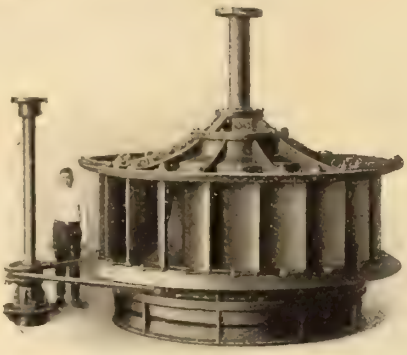
Save Coal and Aid Reconstruction

by an Efficient Development of

WATER POWER

and incidentally, bear in mind,

NO MATTER WHAT YOUR REQUIREMENTS



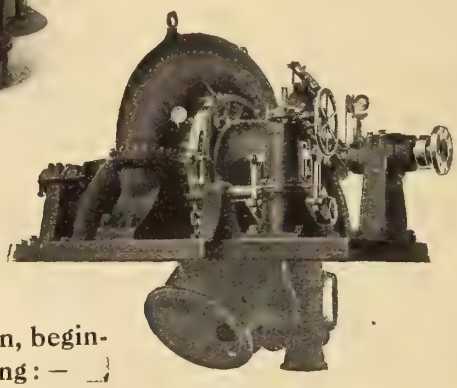
There's a "Smith" Turbine

TO FILL THE BILL.

Of course they cost more than ordinary turbines, but you have the satisfaction of an

ABSOLUTELY DEPENDABLE HYDRAULIC TURBINE

of Maximum Efficiency and Minimum Up-Keep



Look at the Turbines Illustrated and draw your own conclusions

These illustrations, in the order shown, beginning at the top, represent the following: —

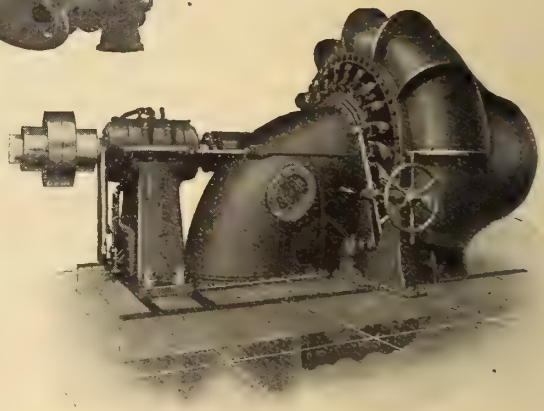
1st.—Single horizontal scroll case unit, direct connected to generator. Two units furnished Buga Electric Co., Colombia, South America, each developing 275 horse power, 900 R.P.M., under 170 feet head.

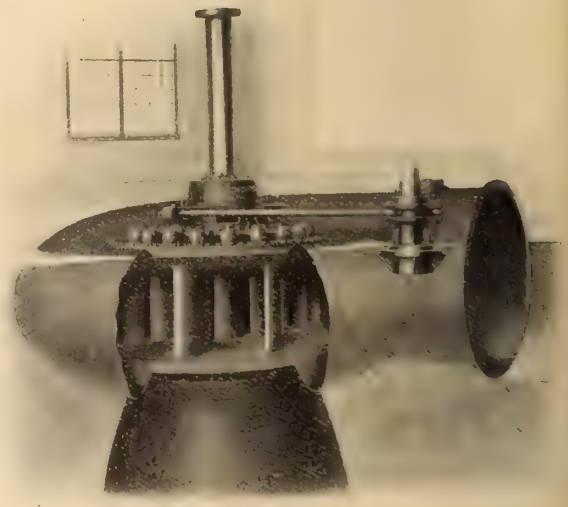
2nd.—Single Vertical Shaft Wicket Gate Turbine, for open flume installation, and direct connection to vertical shaft generator. Two units furnished Electro-Metallurgical Co. of Niagara Falls, for installation in their Glen Ferris, West Virginia plant; each developing 2000 horse power, 100 R.P.M., under 26 feet head.

3rd.—Pair of Horizontal Shaft Smith "Francis" Turbines, mounted on cast iron scroll case; furnished San Joaquin Light & Power Co., Fresno, California; developing 5300 horse power, 450 R.P.M., under 210 feet head.

4th.—Single Special Horizontal Shaft Wicket Gate Turbine, for direct connection to Pulp Grinders. Two units furnished Chicoutimi Pulp Co., for installation in their Ouiatchouan Falls Mill, each developing 1800 horse power, 250 R.P.M., under 230 feet head.

5th.—Single Vertical Shaft Wicket Gate Turbine, enclosed in Plate Steel Scroll Case, with all gate operating mechanism on the outside. This unit furnished Kimberly & Clark Co., Neenah, Wisconsin, for installation in their Niagara Mill; develops 3,000 horse power, 240 R.P.M. under 60 feet head.





If interested in water power, write Dept. "N" for bulletins.

H. B. Van Every, Canadian Representative
405 Power Bldg., Montreal

S. Morgan Smith Co., York, Pa.

Benjamin



Yard Lighting Angle Fixture



Reflector Socket



Gas and Vapor Proof Fixture

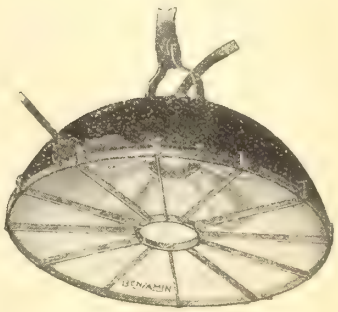


Water Tight Marine Fixture

Electrical Specialties

For Industrial and Marine Use

Illustrated here are some of the BENJAMIN PRODUCTS, the purposes of which, and their application to the requirements of factories, railways, docks. shipbuilding, warehouses, etc., are described in our catalogues. Write for information applicable to your particular needs.



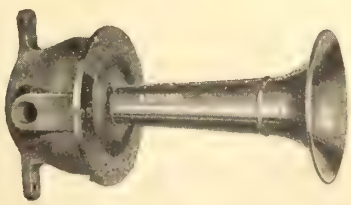
Cargo Light



Water Tight Marine Fitting



Marine Buzzer



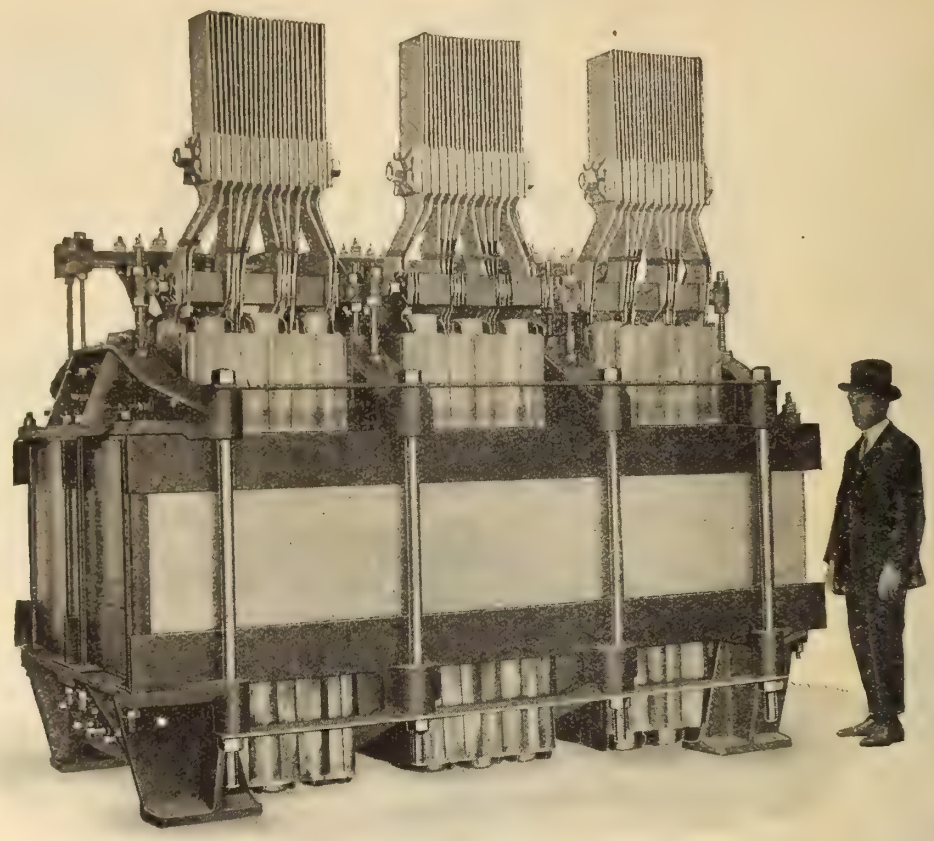
Marine Howler and Industrial Signal



Marine Button and Gong
Water Tight

Benjamin Electric Mfg. Co. of Canada, Limited

Head Office and Works: 11-17 Charlotte Street, Toronto



4500 K.V.A.; 45700—26400—13200 volts to 90—100—110—120—130 volts
25 cycles, 3 phase, Water Cooled Transformer

HEAVY DUTY TRANSFORMERS

FOR ELECTRIC FURNACE WORK

We are specialists in Heavy Duty Transformers for Electric Steel, Ferro Silicon and Carbide Plants. Note the heavy, solid construction of the low tension coils and leads and the rugged bracing of the windings. Crocker-Wheeler efficiency in design—and service—all through.

Let us send you our latest Bulletin—No. 1000

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FERRANTI



Pole Type Transformers

Single and Three Phase

HIGH EFFICIENCY—
LOW CORE and COPPER LOSSES

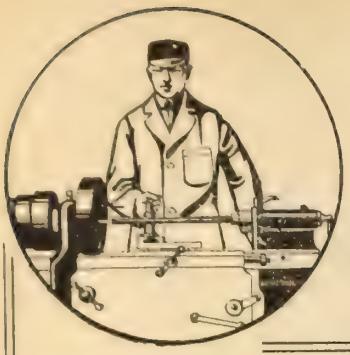
Write us for Prices and Delivery before ordering elsewhere.

House Service and Power Meters, Ammeters, Voltmeters, Current and Potential Transformers supplied from stock.

Ferranti Electrical Company of Canada, Limited

90 Sherbourne St. TORONTO | 704 Unity Bldg. MONTREAL | 592 Notre Dame WINNIPEG

FERRANTI



Give It the Machining Test

Spaulding HARD FIBRE

Send for samples of Spaulding Hard Fibre in sheet, rod or tube form. Work some up. Stamp it, saw it, drill it, bend it, thread it, finish it in many attractive ways.

Get a line on what it costs to "Work up." Remember that Spaulding Hard Fibre machines as neatly as wood, steel or other materials and more quickly, as it is free from metallic particles.

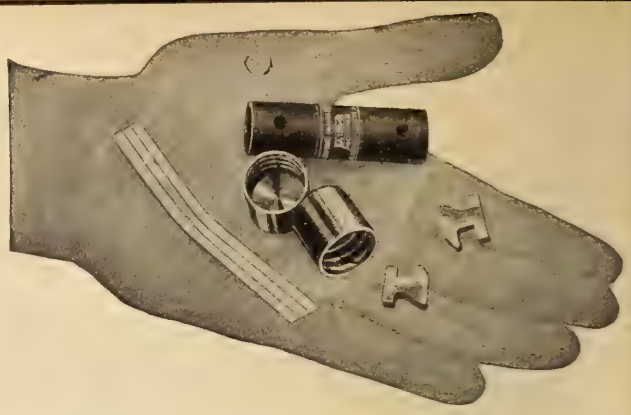
An All Around Material

Its electric rupture is 200-400 volts per 1/1000 in. of thickness; tensile strength 10,000-20,000 lbs. per square inch; compressing point, 38,000-42,000 lbs. per square inch; shearing strength 9,000-13,000 lbs. per square inch.

Made in red, black and grey colors. Send for samples. Our Specialty Department is equipped to machine special parts to your own specification.

J. SPAULDING & SONS CO., Tonawanda, N. Y.
SUBURB OF BUFFALO

449 Broom Street, New York City.
166 Clinton Street, Chicago, Ill.



TRADE AUM MARK **Renewable Fuses**

FOR ELECTRIC LIGHT AND POWER

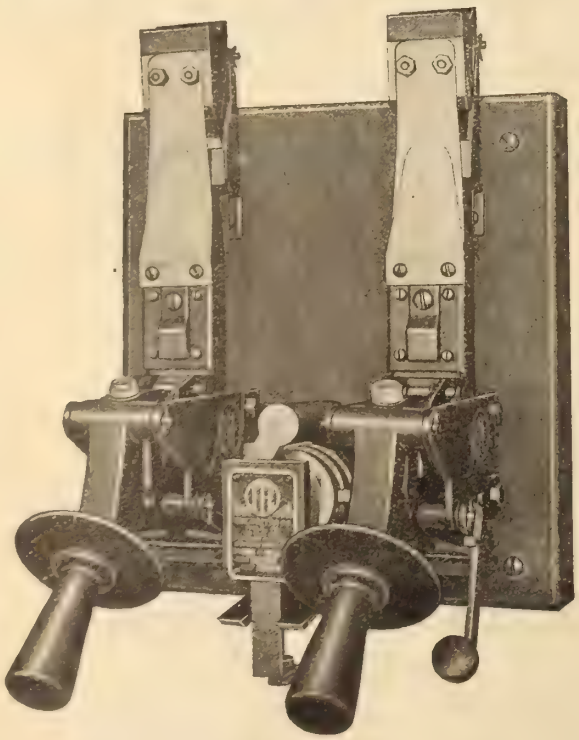
Always were the simplest fuses in construction on the market. The new Type "B," Form 4, has been reduced to the fewest parts—four metal parts of solid brass, a fibre shell and the fuse strip. Caps are removed by a twist of the wrist and as easily tightened, holding the fuse strip in intimate metal-to-metal contact.

Free Samples If You Write Today

A. F. DAUM, Sole Mfr., Pittsburgh, Pa.



I-T-E CIRCUIT BREAKERS



Type W

Rush orders mean unexpected breakdowns unless guarded against. An ounce of CIRCUIT BREAKER PREVENTION will save a ton of trouble.

I-T-E CIRCUIT BREAKERS

pay for themselves frequently before you pay us for them. Prompt deliveries.

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Main Office and Factory: Philadelphia, Pa.

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Indianapolis, Ind., Telephone Bldg.
Chicago, Monadnock Block.
Pittsburgh, Park Building.
Minneapolis, Metropolitan Life Bldg.

ECCLES & SMITH COMPANY
Los Angeles San Francisco Portland, Ore.



O-B Type E. Frog

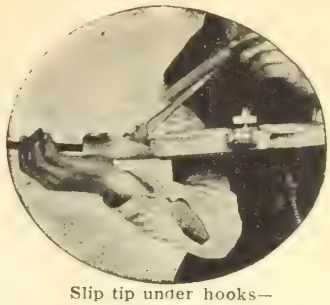
TIME and LABOR SAVING with O-B TROLLEY FROGS

Installation of O-B Frogs is exceedingly simple. The trolley wires are gripped in a single powerful clamp. The Cam Tips are put on as shown in the illustrations at the right. That's all there is to do.

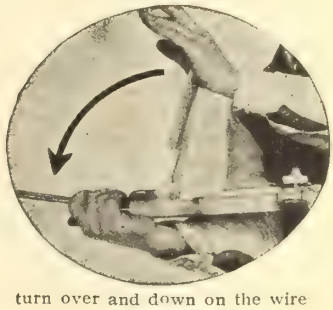
The Cam Tips absorb the first shocks of the wheel and provide a smooth passage from wire to pan. They take the brunt of the wear and may be renewed easily.

Send for "Saving Time on the Line"

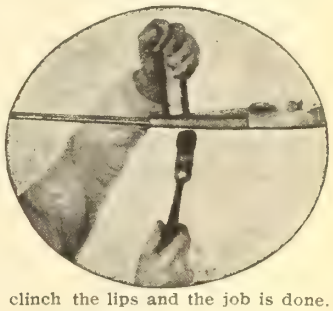
The Ohio Brass Company
Mansfield, Ohio



Slip tip under hooks—



turn over and down on the wire



clinch the lips and the job is done.

Polar Cub HOME MOTORS

The Demand for popular priced Electrical Home Devices has become quite general—Make an asset of this.



SEWING MACHINE MOTOR

Complete outfit for operating sewing machine includes Polar Cub Home Motor, rheostat, cords and plug and sewing machine attachment.

There is an extremely big demand for an item of this kind. Packed in substantial carton with attractive label.

Can also be used with all other Polar Cub Home Motor Attachments. **Retail price $15.50.**

Separate Vibrator Churner and Mixer Polisher and Grinder and Fan Attachments Retail at $1.50 Each.

Can be used with the Sewing Machine Motor.

You can get complete units of any of the above.

Retail $15.50



DELUXE CABINET

Polar Cub DeLuxe Cabinet contains complete Polar Cub Home Motor with all Attachments. Includes Home Motor, Base, Rheostat, cords and plug. Churn and Mixer Attachment, Polisher and Grinder Attachment and Fan Attachment.

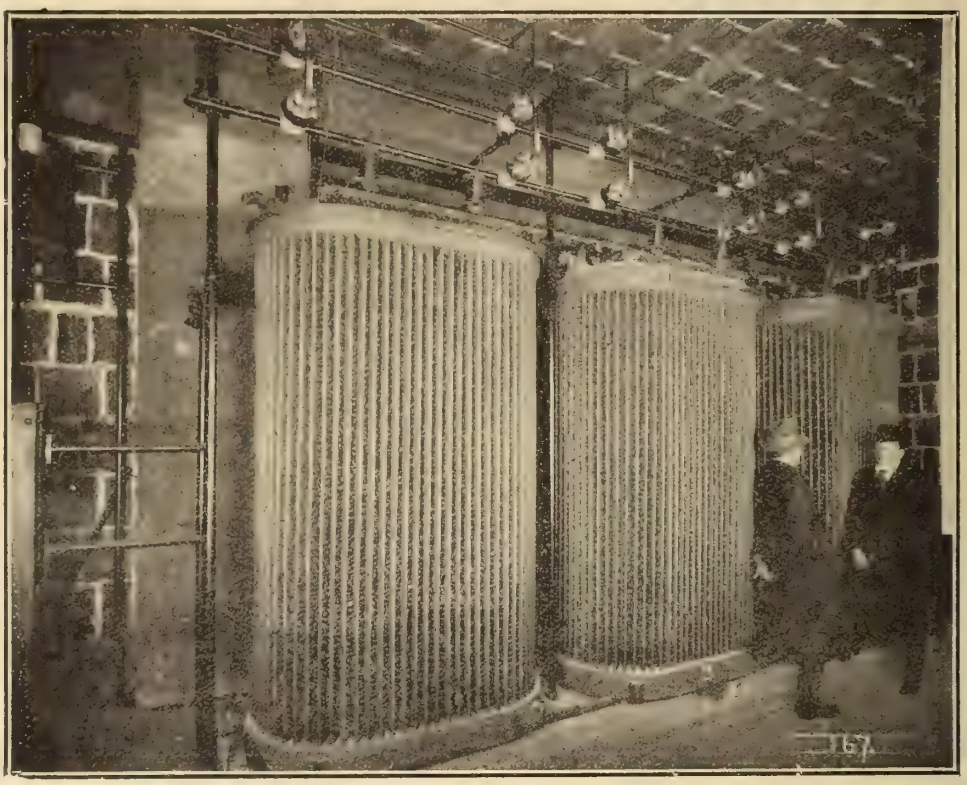
All in stained hardwood cabinet lined with silk and makes a very handsome set. **Retail price $25.20.**

The Sewing Motor is a good Xmas Gift—The Deluxe Cabinet is a Grand Gift

The A. C. Gilbert-Menzies Company, Ltd.

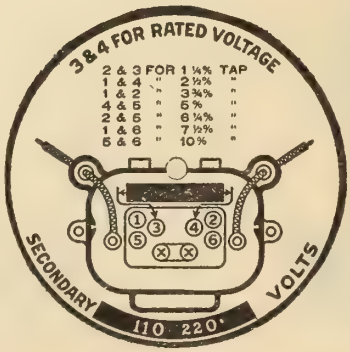
439 King Street W.
TORONTO

TRANSFORMERS



Moloney Pole Type Transformers

are all supplied with brass plates fastened on the inside of the cover of of each transformer: all connections marked plainly. They do not get covered with dirt or stained with oil like a blue print does. You always have them before you when changing taps. Heavy bushings eliminate breakages in shipment or handling.



Moloney Transformers are manufactured in a factory that was built especially for that purpose only. They are designed by Engineers and built by men who make a specialty of this work.

Made in Canada

MOLONEY ELECTRIC COMPANY OF CANADA, LIMITED

Factory
Windsor, Ont.

Head Sales Office
Bank of Hamilton Bldg., Toronto

Branch Offices
Montreal, Halifax, Winnipeg, Vancouver



Production Records Which Make Sales For the Motor Distributor

When the production Manager and Factory Superintendent see production climbing to new records month after month, they are not unmindful of the part equipment reliability plays in helping reach the new records. Reliability in the motors which drive the factory machinery has a greater significance to them than to the man who signs the orders.

When equipment makes good on a production basis, the man who sold it can count on the active co-operation of the factory executives when additional equipment is required.

The regularity with which R & M Motors are specified on repeat orders wherever they have been introduced, reflects the good will of the factory executives—the men who are in the best position to judge their service records. And good will which extends beyond the purchasing department out into the shops is a sales asset of immeasurable value to the motor distributor, a dependable guarantee of a permanent, growing motor business.

THE ROBBINS & MYERS CO., SPRINGFIELD, OHIO.

New York, Philadelphia, Boston, Buffalo, Cleveland, Cincinnati, Chicago, St. Louis, San Francisco.

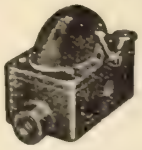
CANADIAN DISTRIBUTORS

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Costello & Crowe Ottawa
Dawson & Co., Ltd. Montreal
La Cie Codere & Fils, Inc. Sherbrooke
Mechanics Supply Co., Ltd. Quebec
Eastern Electric Co. St. John
John Starr, Son & Co., Ltd. Halifax
Great West Electric Co. Winnipeg
Rogers Electric Co., Ltd. Toronto

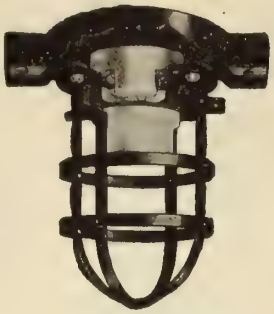
Robbins & Myers Motors

CONDULETS

Electric Condulet Outlet Fittings That Meet Every Marine Wirin Need.



Type FS Condulet Body With Water-tight Cover for Operating Flush Switches



Type GV Weather-Proof Condulet with Guard

These Cuts Barely Suggest the Line.

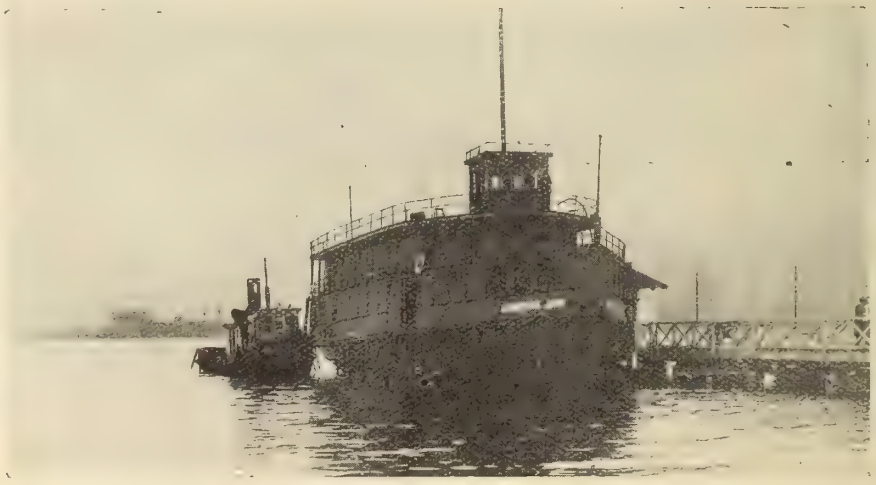
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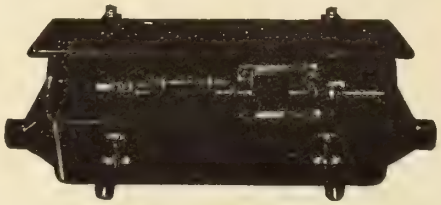
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Are Hardware Stores the Best Medium for Distributing Electrical Appliances?

In recent issues we have referred a number of times to the conditions under which electrical devices are being retailed—amounting almost to a monopoly of the business, in many centres, by the hardware trade. Is this a desirable condition? Is it in the best interests of either the manufacturer, the jobber, the contractor-dealer, the central station or the public?

Strangely enough, the hardware dealers appear to have taken it for granted that they are the logical medium through which electrical merchandise must reach the public. For example, in a recent issue of a hardware trade journal a number of "kicks" are registered because in certain cases the electric stores in the locality presume to sell at a lower price than the hardware men think proper. Perhaps the conscience of the electrical dealer is not yet sufficiently elastic to allow him to charge profits which appear quite right to the hardware man, or it may be that there are other reasons. Is it not reasonable that the merchandising of up-to-date electrical goods, representing a quick turnover, ought to be done at a lower profit and that when the hardware man places these goods on the same basis as his own stock, often representing a big percentage of junk, he is treating the electrical business unfairly and actually retarding its progress. The article in question speaks of central station price-cutting, but it seems highly improbable under the power shortage conditions of the past few months that any central station will throw money away to create a condition of greater demand that they do not want.

The fact seems to be that hardware stores are not the **logical** channels through which we should distribute electrical goods to the public. Manufacturers and jobbers have placed their goods with hardware stores simply because this arrangement offered an opportunity of widening the market. They did not stop to consider the after effects of placing their goods in inexperienced and unsympathetic hands and the result has undoubtedly been, in many cases, dissatisfied customers and discredited merchandise.

Of course, it is one thing to say there ought to be enough electrical stores to take care of this business and quite another thing to get them going. It is doubtless evident to the contractors, too, that a fine line of profitable business is going to waste for want of proper taking care of. But, after all, the trouble seems to be that the contractor, pure and simple, knows little about retailing, which to-day has become something of a science. He is not interested in getting behind the counter and selling. As opposed to this the hardware trade has the selling organization all ready.

If one may sum up the situation, it appears to be a matter of choice between two conditions, neither of which offers an immediate solution. If the merchandising of electrical goods is to be placed in the hands of the hardware trade, their salesmen must become acquainted with the general technical conditions surrounding the installation and operation of such equipment. On the other hand, if it is left to electrical contractor-dealers these latter must inform themselves of the principles underlying the business of retailing. It is probably a toss-up which way would offer the least resistance, but it is reasonably certain that the hardware men will not give up a promising line of business without a struggle, and that if the electrical contractor wants to keep the distribution of electrical devices and equipment in his own hands he must hustle—right now.

Successful Anniversary Session of Toronto Section American Inst. Elec. Eng.

The 15th anniversary of the formation of the Toronto branch of the American Institute of Electrical Engineers, which was at the same time the 344th meeting of the parent Institute, was held in Toronto on November 22-23, at the Engineers' Club, and will long be remembered for the splendid efforts of the officers and members of the Toronto section. There was a record attendance at the reading of the papers and at the various functions, and the keenest interest was evidenced by the members and friends of the Institute in the proceedings throughout.

The officers of the parent society arrived in Toronto on Friday at noon and were entertained by the Toronto executive to luncheon at the Engineer's Club. Following a few remarks by the President, the technical session began immediately with Mr. Arthur H. Hull, electrical engineer, Hydro-electric Power Commission of Ontario, reading a paper on "Power Development in the Province of Ontario." This paper is reproduced in liberal extract on other pages of this issue. An interesting discussion followed Mr. Hull's paper, in the course of which Mr. F. A. Gaby, chief engineer of the Commission, explained the plans of the Commission to build up a network of distribution covering Eastern Ontario from power developed on the St. Lawrence River, which would be tied in with the Niagara System at some point east of Toronto, so that practically the whole of the province could, in an emergency, be fed from either the Niagara Falls or the St. Lawrence system.

The second technical paper was read by Mr. W. G. Gordon, transportation engineer Canadian General Electric Company, on "The Electrical Equipment of the Canadian

Number Tunnel in Montreal." Mr. Gordon's paper is extracted elsewhere in this issue.

In the evening, at 6.30, the delegates and members met at the Engineers' Club, where the guest of honor was Sir Robert Falconer, president of the University of Toronto. Sir Robert gave a splendid address, describing certain phases of his recent visit to the front line trenches in France, where he had been the guest of General Currie on the evening preceding and during the days which followed the battle of Amiens. Sir Robert emphasized the value of this war to Canadians in teaching them their powers of organization. This was in no way better illustrated than in the operations of the four divisions under General Currie, where everything moved like clock-work and every man, as if automatically, performed his duty. Canada has, of course, lost much in the war, but she will have made a corresponding gain if the lessons of organization that have been learned are put into effect in the business life of the nation during the reconstruction period and afterwards. Sir Robert paid a glowing tribute to the work of the Canadian engineers in France.

Mr. Arthur H. Hull, chairman of the Toronto section, in thanking Sir Robert for his fine address, spoke of the very large number of graduates and under-graduates of the School of Science—some 600—that had responded to the duty call in defence of the Empire.

At 8 o'clock the meeting adjourned to the Chemistry and Mining Building of the University of Toronto, where Mr. S. Svenningson, designing engineer of the Shawinigan Water and Power Company, Montreal, described the 110,000 volt transmission line over the St. Lawrence River. This paper is reproduced in full elsewhere in this issue.

On Saturday morning the delegates assembled at 9.30 at the Engineers' Club and were motored away, as their choice prompted, for an inspection of the Leaside Munitions Plant, the British Forgings and Steel Plant, or the Hydro-electric Laboratories on Strachan Avenue, returning for the final luncheon given by the reception committee at the rooms of the Toronto Board of Trade.

The proceedings throughout were a splendid tribute to the energy and ability of the officers of the Toronto section of the A. I. E. E. Everybody worked hard, from the chairman to the last member of the entertainment and reception committee, but special recognition is due Mr. A. H. Hull and the secretary, Mr. E. V. Pannell.

Canada's Need

Canada is fortunate in possessing a large number of valuable waterpowers. It is unfortunate in possessing apparently a large number of people who are anxious to prevent the development of these waterpowers.

Although in the muck-raking literature of the last ten years, the development of waterpowers has come in for an undue share of attention, few people realize that after all some 90 per cent. of the total amount of power utilized on the continent of North America is developed from coal by means of steam plants, and that only about 10 per cent. is developed from waterpower.

This overwhelming use of steam power, as against water power, is due to the economic reason that it was cheaper to put in the steam plants and operate them, than to develop waterpowers under the conditions surrounding the development of these waterpowers.

Waterpowers have important uses. The principal economic use of waterpowers to-day is to serve these industrial purposes where the load is practically continous. Such loads include the grinding of wood pulp, the operation of large industrial plants which operate continuously, and principally the operation of electric furnaces where, combined with the continuous use of power, is to be had a further advantage in the high temperature of the electric arc.

Canada is similar to some other northern countries, such as Norway, in having waterpowers. The coal which Canada possesses is limited and located in the extreme East and West of the country, so that the expense of getting the coal is now, and probably will be higher than in countries like England and the United States. It is therefore essential that the waterpowers be utilized to the maximum extent possible, so as to decrease the amount of coal which is purchased from abroad. By using one of our own resources instead of buying the material outside the country, a distinct economic gain accrues, always provided that the expenditure for the waterpower itself, the method of development etc., are undertaken and carried through in such a fashion that there will really be a saving by its operation.

The total amount of energy used for lighting purposes, and for the small user, that is the home user or the minor factory, does not exceed 25 per cent. of the total energy developed for electric power purposes. The other 75 per cent. is used for industrial purposes by a relatively small number of consumers, namely—the capitalists who have been held in such scorn.

For the last several years, the tide has been turning against the Government owned and controlled and operated electric power systems, and to-day few people in their ordinary senses would recommend the distribution of electric power by public bodies.

Arguments may be advanced to show that lighting is really a public utility, and should be a Government enterprise, and arguments may be advanced properly that Government control should be exercised to see that suitable precautions are taken both in the formation of the companies and in the control of the rates; but, dealing with the great resources which this country has in its waterpowers, it is more than obvious that in order to obtain rapid development of these waterpowers, with immediate benefit to the country, private concerns must furnish the money. Conditions made by the Government must be such as will attract private individuals and stimulate enterprise.

The Dominion of Canada, and particularly the Province of Quebec, has a great opportunity in the next few years of establishing a vast series of waterpower developments. Such developments will lead to the investment of large amounts of money, the employment of many men during the construction period, and the establishment of huge industries to use the electric power when developed.

With the creation of these industries will come the ability to export from this country the products made with electric power; and we will thus be turning into money natural resources which are now being wasted, and bringing that money back into this country to add to our wealth.—From an article by Mr. Julian Smith on the subject "Canada's Need," in the Montreal Star.

The Electric Club of Toronto

Two specially fine meetings of the Electric Club of Toronto were held on November 15 and November 22. On the earlier date the Hon. Geo. S. Henry, L.L.B., Minister of Agriculture for the Province of Ontario, addressed the members on "Agriculture—Yesterday and To-day," pointing out the progress that had been made in the rural districts of this province in spite of the tremendous handicaps of labor shortage and the competitive fertility of the western provinces as grain-growing areas. Mr. Henry also referred briefly to the improvement in the province's live-stock, pointing out that an Ontario-bred animal was recently sold for a price which constituted a record for this continent. Mr. Henry also

took occasion to rectify certain misapprehensions that have been expressed by the city man from time to time that the rural communities had not done their share either in supplying man-power or money towards the prosecution of the war and gave figures to show that the percentage subscribed both in population and in wealth was at least equal to anything the larger centres could boast.

On November 22nd the Club was addressed by Mr. Arthur V. White, consulting engineer to the Commission of Conservation on "Canada's Heritage in the St. Lawrence River." Mr. White's paper is reproduced in full elsewhere in this issue. On the latter occasion the Club was honored with the presence of Mr. James White, assistant to the chairman of the Commission of Conservation.

Montreal Electric Luncheon

After an interval of several weeks, due to the influenza epidemic, the Montreal Electrical Luncheon resumed its meetings on November 20. The speaker was Mr. E. S. MacNab, of the train lighting department of the C. P. R., who described the organization of a standard Canadian railway. He pointed out the high degree of organization necessary for the smooth working of a railroad, and incidentally referred to the good results of co-ordination in the allied forces and in the Victory Loan Campaign. The appointment of Marshal Foch and the pooling of supplies and funds had gone a long way to achieve victory. Canadian railroads had an approximate mileage of 32,700 miles, and 5,300 locomotives. Germany, said Mr. MacNab, had to hand over to the Allies within about 200 locomotives of the entire total in Canada.

The speaker then gave details of the system on which railroads are run—from the president down to the trackmen, pointing out how various departments are controlled by the vice-presidents, how the lines are split up into divisions, and how the work is minutely sub-divided. The electrical work is, from the administrative point, handled in different ways on various North American roads. Mr. MacNab also contrasted the Old Country methods of controlling railroads with those on this side, stating that the different conditions called for varying systems. A collection for the Red Cross fund totalled $41.50.

Sympathetic references were made to the deaths of Mr. F. N. Ormsbee, of the Standard Underground Cable Company of Canada, his wife and child; Mr. H. E. Randall, of the Shawinigan Water & Power Company, and Mrs. Burnett, wife of Mr. F. C. Burnett, of the Canada Cement Company.

50-Ton Electric Locomotives for Hydro

Twelve 50-ton electric locomotives are being built by the National Steel Car Company, Ltd., Hamilton, Ont., for the Hydro-electric Power Commission of Ontario. They will be used for hauling trains on the construction railway which is being built in connection with the power development at Chippewa Creek near Niagara Falls. Operation will be at 600 volts, direct current.

The locomotives are designed for double-end operation, with general dimensions as follows:

Length over all	35 ft.
Truck centers	19 ft.
Length of main cab	10 ft.
Length of auxiliary cab	9 ft. 6 in.
Width over side sills	9 ft.
Height from rail to top of floor	4 ft. 6½ in.
Height from rail to top of cab roof	12 ft.

Details of Construction

The underframe is made up of I-beams and channels. The center, side and intermediate sills are 12-in. I-beams running continuous from end sill to end sill to which they are secured by connection angles. The end sills are 12-in. channels extending straight for 15 inches on each side of the center line and dropping back 13 inches to the corner of the underframe. Cross-ties, of which there are five, consist of 8-in. I-beams connected to the longitudinal sills by angle connections. The bolster is composed of 14-in. x 1-in. plates riveted to the top and bottom of the longitudinal sills. The flooring, except in the cab, consists of cast-iron blocks 2¾ in. thick with checkered surface.

The draft gear is of the Miner twin spring type with M.C.B., class "G" spring and keyed-yoke connection to the M.C.B. coupler.

The cab is of all-steel construction, except the roof, which is made of poplar tongued and grooved and covered with 8-oz. cotton duck. The side and end posts are 3-in. channels, while the corner posts are 3½ in. x 3½ in. x ¾ in. angle. The outside sheathing is No. 16 gauge sheet steel, and is lined inside with wood lining. Each side of the cab is provided with two drop-sash windows and one swing door. Each end is provided with two stationary windows, one drop sash window and one swing door. The doors are in diagonal corners as are also the drop-sash windows. All control levers and handles are duplicated in diagonal corners for reversible operation.

The hood at each end of the cab is of all-steel construction and is composed of angles, channels and No. 16 gauge sheet steel. Inside the hood are the air compressor, large sand box, air-operated sanding device, and electrical equipment and a removable steel door is provided for easy access. The hood is narrow enough to allow a walkway around the outside of the platform. A pipe railing is provided at the outside edge with a hand railing around the top of the hood.

Trucks are of the arch bar design, with inside-hung brakes, 5½-in. x 10 in. journals and 36-in. diameter wheels. Each truck bolster is composed of two 10-in., 40-lb. rolled I-beams supported by helical springs. Each truck is provided with two inside hung 125-h.p. motors suspended from brackets secured to channel transoms.

Special Air Equipment to Operate Dump Cars

The locomotives are being equipped with Westinghouse air brakes, with 14-in. x 12-in. type "S" cylinders, the main reservoirs, parasite reservoir and radiating pipes being located on the top of the floor at the side of the hood. Two D-4-P, 50-ft. Westinghouse motor-driven compressors will furnish sufficient capacity to supply air to the dumping mechanism on twelve 20-yard dump cars, and the parasite governors are provided and so arranged that when operated in trains all governors will cut in at the lowest setting pressure in the series, and will prevent the dumping apparatus from depleting the pressure available for braking below a safe predetermined minimum. The hand-brake equipment is operated from inside the cab by a vertical hand wheel connected by bevel gears to a shaft running through the cab floor.

The locomotives will be equipped with multiple-unit control, six having General Electric control and six Westinghouse control. Each locomotive will develop at starting a tractive effort of approximately 30,000 lbs. on dry rails.

The Canadian Bond Hanger and Coupling Company have moved their plant from Alexandria, Ont., to a very modern and up-to-date building at the corner of Villiers and Munition Streets, Toronto. The head office of the company will also be at this address. Sufficient ground adjoining the plant has been purchased to render capacity for expansion almost unlimited. The company state that in the new plant they are already in a position to double their former output.

Block Bus System of Distribution

Owing to the unfortunate circumstances resulting from the influenza epidemic, a recent meeting of the Toronto section of the A. I. E. E. was cancelled. At this meeting it had been announced that Mr. G. E. Stoltz would read a paper on "Steel Mill Electrification," and in this connection we have an interesting letter from Mr. A. H. Winter-Joyner, referring to the "block bus" system now being more generally used in the transmission and distribution of large blocks of power for short distances. Mr. Joyner sends us an interesting discussion on this system which followed the reading of a paper at a recent meeting of the Association of Iron and Steel Electrical Engineers, which is so timely and full of interest that we reproduce it in full. The members of the Association had just completed an inspection of the Carnegie Steel Company's mills at McDonald, Ohio.

Discussion on "Block Bus" System of Distribution

D. M. Petty: As to distribution system, if feeders run through the plant to a sub-station, and from step-down transformers to some particular mill, one feeder for each mill, a large number of feeders will be the result. This system of distribution is called the "Radial" feeder system. There are other systems and the one which we have been looking at to-day is known as the "block bus" system. I believe we would be glad if Mr. Gaudy would give us a discussion covering what he considers the advantages of the block bus system.

R. J. Gaudy: Undoubtedly, it came to the mind of a number of you that it was rather an unjustifiable step to take, considering methods previously common. In this installation which we saw to-day, the engineers for the Carnegie Steel Company were, after careful study, assured that this project justified the move towards a newer type of simplified distribution. It should be gratifying to them to note that groups of engineers elsewhere have recently met distribution problems in handling large blocks of load over reasonable distances, and have adopted identical solutions. It is obvious that the block power bus scheme is partially applicable only where the blocks of load or load centres are sufficiently large, and so located that a double transformation is uneconomical. It should be considered comparable only to other methods of distribution having similar selection of voltage. The block bus scheme is, of course, not applicable where the items of load are very small, and so widely separated that they do not lend to handling from reasonable load centres. There are under construction at this time, some fine examples of similar distribution.

In station construction, it is commonest practice to use a bus for distribution from large blocks of generating capacity to adjacent switching positions. The McDonald installation is identical in scheme, the only change being the location of the bus switch at the load block, and the extension of the length of the bus between the supply and the load with the elimination of the lines otherwise necessary between the bus switch and the load centre switch.

The difference between the block bus distribution system and that of any other type, gives rise to some surprise until you overlook the novelty of the thing and consider its advantages.

1. The conductors are bare copper in air; which condition is the most advantageous possible considering the disposition of heat produced by losses.

2. The conductors are rigid and are ruggedly supported so that no difficulty can arise from mechanical stress developed magnetically.

3. The insulating medium is free from possibility of becoming moisture soaked and breaking down.

4. The conductor is insulated by a material which will not fail or deteriorate under temperature change. This feature is one which, for steel mill load, presents great advantage. Changes in the load requirements may occur on very short notice. Production in one portion of the mill may be doubled or trebled during a period which will not allow of procuring and installing additional distribution line material. The block bus system may be installed so that all characteristics are best selected for the anticipated loads, but when local or general increases come on there is absolutely no danger of failure due to temperature damage to insulation. This is of great advantage to the steel mill electrical engineer because his distribution will immediately take on a load addition which would be an undue overload on any other distribution having equal conductor in place.

5. The switch gear necessary for any loading is much reduced, for instead of a multiplicity of lines protected by individual switches and against each other, you instal a bus line so well that it will not get into trouble and are limited only to the capacity of switch gear available, which is at this time no mean limit.

6. If the location of the load blocks suggest either a block bus line or loop, loads may be added at any point, requiring at the most only the addition of bars to the stack to restore accurate characteristics desired.

The fact that the operating characteristics of bar copper in air are not so widely known as the characteristics of other transmission materials is mainly because they have not been so universally used in the past decade. The values of all characteristics such as power loss, voltage drop, regulation, temperature rise, a.c. resistance and reactance were predetermined and have been verified in the bus system at McDonald. All the data bearing on these characteristics are available and the bus design may be now handled just as intelligently as any other conductor arrangement on which you have accumulated information.

Wm. M. Hornlein: Are conductors tapered?

R. J. Gaudy: Yes, they are tapered as the load is taken off.

D. M. Petty: Condensation in a place of that kind will occur where there is marked change in temperature in a comparatively short time. If the change in temperature occurred slowly, the moisture in the air practically takes care of itself.

Wm. M. Hornlein: Any possibility of moisture causing corrosion, etc., of the supports? In other words, what will be the up-keep of the system?

R. J. Gaudy: The equipment installed has been protected against possibility of corrosion. The insulation selected by the engineers here will allow for insulating at that voltage during heaviest rainfall, which condition it would, of course, be impossible to obtain in that tunnel.

V. L. Crawford: Is this the first installation of this kind of distributing system?

R. J. Gaudy: It is, I believe, in the steel mills. Some of the central stations and construction engineers have gone into it very extensively. I do not know of any bus installation now operating that is any longer than this present bus. For one item of load there are several installations of that kind, that is, where one block motor load utilizes the entire line. I believe the installation you saw to-day, however, still has the blue ribbon. I believe the blocks are sufficiently large to allow that.

Max Nain: Would maintenance be cheaper on block type?

R. J. Gaudy: Yes, and the possibility of failure due to overload almost absolutely eliminated.

A correspondent would like to hear from any man who contemplates striking a match in South Kensington, with a view to sharing same.—Punch.

Power Generation in Ontario on Systems of Hydro-Electric Power Commission

By Mr. Arthur H. Hull*

The Province of Ontario is the largest and most populous of the Provinces in the Dominion of Canada, having an area of 407,262 square miles and a population (census 1911) of 2,523,274. Ontario's population is about 35 per cent. of the total of Canada's population, and its area is 10.9 per cent. of the total area of the Dominion. Ten per cent. of its area is water.

Ontario has developed into the greatest manufacturing Province in Canada and as there are no coal deposits in the Province, its abundant water power resources are being more and more utilized to furnish the power required for its varied and increasing industrial development. Other fuels, such as natural gas and petroleum are found in the southern part of the Province, gas along the north shore of Lake Erie and petroleum near Sarnia. The natural gas supply, however, is insufficient for present purposes and the quantity of petroleum produced does not begin to meet the needs of the Province. The demand for electric power has increased during the past ten years to such an extent, that, with the war industries in operation, it became necessary to impose restrictions on private and municipal consumers in order to provide the power required by the war industries. The great saving in coal effected by the use of electric power in Ontario's industries is one of the most important aspects of the electric power situation, and further great savings can be, and will be before long, brought about by the electrification of the steam railroads.

Mr. H. G. Acres, (hydraulic engineer, Hydro-electric Power Commission), in a monograph on Water Powers of the Province of Ontario, written in 1915, gives the following summation of water power capable of development, and of water power already developed in the Province:

Division	Potentiality	Developed.
Ottawa River & Tributaries....	688,000 h.p.	71,000 h.p.
Great Lakes Tributaries..	446,000 h.p.	137,000 h.p.
Hudson Bay Slope..	250,000 h.p.	22,000 h.p.
James Bay Slope	1,500,000 h.p.	70,000 h.p.
International Boundary Rivers..	2,045,000 h.p.	462,000 h.p.
	4,929,000 h.p.	702,000 h.p.

Of the above total for power developed, about 69,000 horse power is used in pulp and paper manufacture, about 59,000 horse power is used as hydraulic power directly applied, and the balance 574,000 horse power is converted into electric energy for light and power.

This paper will deal only with the generation of electric power by the Hydro Electric Power Commission of Ontario which is now the largest producer and distributer of electric energy in the Province

The Hydro Electric Power Commission of Ontario, which will be referred to hereafter as the Commission, was formed by the Ontario Government in 1906, and first furnished power over its 110,000-volt lines from Niagara Falls in October 1910, the power being purchased from the Ontario Power Company of Niagara Falls, Ontario. It was not until August 1st, 1917, that the Commission obtained direct control of the generation of power at Niagara Falls, through the Ontario Power Company, but in other parts of the Province, the Commission had started to develop its own power by constructing a hydro-electric plant at Eugenia Falls on the Beaver River near Flesherton, which was put into operation in November 1915, and one at Wasdell's Falls on the Severn River which was started in service in October 1914. In 1914 the Commission acquired by purchase the Simcoe Railway and Power Company, whose generating station at Big Chute on the Severn River had previously supplied power under contract to the Commission's Severn System, supplying the district around the southern part of Georgian Bay. In March, 1916, the Government of Ontario purchased the entire holdings of the Electric Power Company which, through subsidiary companies, was generating power on the South River near Nipissing, on the Otonabee River at Peterboro, and on Trent River at Healy Falls, Frankford, Campbellford, and Trenton. The operation of the equipments thus acquired was placed in charge of the Commission in June, 1916.

The various areas in the Province served by the Commission are designated by systems as follows:

System	Main transmission voltage	Frequency	Phase	Power obtained from
Port Arthur System ...	22,000	60	3	Kaministiquia Power Co.
Nipissing System	22,000	60	3	Comm's Nipissing Station
Muskoka System	22,000	60	3	Comm's So. Falls Station
Wasdell's Falls System.	22,000	60	3	Comm's Wasdell's Falls Stn.
Severn System.	22,000	60	3	Comm's Big Chute Station
Eugenia System	22,000	60	3	Comm's Eugenia Station
Central Ontario System.	44,000	60	3	Comm's { Healy Falls Stn. Auburn Station Campbellford Stn. Frankford Station Trenton Station
St. Lawrence System ..	26,400	60	3	M. F. Beach Company
Rideau System	25,700	60	3	Rideau Power Co.
Niagara System	110,000	25	3	{ Comm's Ontario Power Co's Station Canadian Niagara Co. Electrical Development Co. Queenston Development (future)

Port Arthur System

In the Port Arthur system, power is purchased at 22,000 volts, three phase, 60 cycles from the Kaministiquia Power Co., and is delivered to the City of Port Arthur at 22,000 and at 2200 volts, part being transformed in the Commission's Transforming Station in Port Arthur, containing two banks of transformers, each consisting of three 750 kv.a. units connected star-delta neutral ungrounded.

In order to take care of the future requirements, the Commission now propose to construct a Hydro-electric station on the Nipigon River at Cameron's Pool, about 80 miles from Port Arthur, which will have an ultimate capacity of about 50,000 horse power. The engineering work is now under way for this development. It is proposed to transmit the power at 110,000 volts, three phase, 60 cycles, to Port Arthur. Three other power sites on this same river, when developed, will, together with the Cameron's Pool site, give a total of 150,000 horse power. The needs of the Port Arthur district should, therefore, be amply provided for, but if additional power should be required for this district, another site is capable of development at Silver Falls on the Kaministiquia River about 25 miles from Fort William where with a 350-ft. head a total of 25,000 horse power can be developed. At the present time the electric energy supplied

*Electrical Engineer, Hydro-Electric Power Commission of Ontario, and Chairman Toronto Section A.I.E.E., before Toronto meeting A.I.E.E., November 22, 1918.

at Port Arthur is used for operation of the street railway, for public and domestic lighting, and for large grain elevators, ship yards, coal docks and miscellaneous industrial purposes.

Nipissing System

The Nipissing System, formerly controlled by the Nipissing Power Company, comprises a generating station on the South River near Nipissing Village, sub-stations in Callander, Powassan and North Bay. The generating station contains two 450-kw. three-phase 3200-volt 60-cycle 450-rev. per min., horizontal generators with 12.5-kw. 125-volt direct-connected exciters, each unit direct coupled to a water wheel of 925 b.h.p. at 86 ft. head. Water for this plant is taken from the South River through an open canal 900 ft. long, then through a wood stave pipe 6 ft. diameter 2300 ft. long to a differential surge tank 72.5 feet high, close to the power house, a steel penstock connecting thence to the turbines. The storage pond has an area of about 100 acres and the drainage area of the river is about 350 square miles. Provision was made for extension, and by additional storage works, it is possible to increase the capacity to 2500 horse power.

Muskoka System

The power house on the south branch of the Muskoka River at Muskoka Village was formerly owned by the Municipality of Gravenhurst and was taken over by the Commission in the latter part of 1915, and has been remodelled and enlarged, and now supplies power over a single circuit 22,000-volt, three-phase, 60-cycle line about 26 miles long to Huntsville, and at 6,600 volts three phase, 60 cycles, to the municipality of Gravenhurst over the municipality's line.

The equipment in this station now comprises one 450 kv.a., three phase, 6,600-volt, 720-rev. per min., 60-cycle generator, direct connected to a 500 b.h.p. turbine, and one 750-kv.a. similar 720-rev. per min. generator, direct connected to a 1,000 b.h.p. turbine. The hydraulic head at this plant is 102 ft. The water is conducted through one steel and one wood stave pipe, each 946 ft. long to the turbines.

Wasdell's Falls System

This system comprises a hydraulic generating station on the Severn River at Wasdell's Falls near Severn Bridge, and sub-stations at Beaverton and Cannington. Power is transmitted to Beaverton and Cannington over a single-circuit steel conductor line at 22,000 volts, three phase 60 cycles, and over a single circuit aluminum tie line at the same voltage to the commission's Severn system, connecting at Longford with the town of Orillia 22,000-volt lines from Longford via Orillia to the Big Chute generating station.

The generating station is interesting on account of the low hydraulic head. The normal head is 12 ft., but variations from 9 to 15 ft. occur. The equipment consists of two 400 kv.a., 90 rev. per min., vertical type 60 cycles, three-phase, 2,300 volt generators connected through flexible couplings to turbines rated at 600 horse power at 100 per cent. gate opening with 12-ft. head.

Severn System

This system comprises a hydraulic generating station on Severn River at Big Chute with substations as shown in the diagram. The generating station as originally built in 1909 by the Simcoe Railway and Power Company contained three 900 kv.a., three-phase, 2,200 volt, 60 cycle, 300 rev. per min., horizontal-shaft generators direct connected to turbines each rated at 1,300 horse power under 56-ft. head. An extension to the building has been made by the Commission during the past year, and there is now being installed one 1600 kv.a., three phase, 60 cycle, 2,200 volt, 300 rev. per min. horizontal generator direct connected to a 2,300 h.p. turbine. The switching equipment is being rearranged to provide a double high-tension bus for greater flexibility in operation. Space is left for a a third bank of transformers, and for two future 22,000 volt line equipments. A double low-tension bus is installed. All power is transmitted at 22,000 volts, three phase, over four lines. An interesting feature of the transmission lines of this system is the long spans across Matchedash Bay at Waubaushene, one being 1,135 ft. long and one 858 ft. long. The west shore tower is 175 ft. high, the middle and east shore towers are 88 ft. high. No. 00 B&S 19 strand copper conductors are used on these spans.

The water is taken from the river through a canal 500 ft. long to the head works and then through two steel penstocks 170 ft. long to the turbines.

Eugenia System

This system obtains power from a hydraulic generating station constructed by the Commission at Eugenia on the Beaver River and was placed in service in November 1915. Extensions are now almost completed to provide double the output. This development is one of the most interesting in Ontario, and has the distinction of having with one exception, the highest hydraulic head of any plant in Canada, being 552 ft. gross. It is also one of the highest heads in the world using reaction wheels.

The first installation consisted of two 2250 h.p. turbines each direct connected to 1410 kv.a., three-phase, 4,000 volt., 60 cycle, 900 rev. per min., horizontal shaft generators having neutral grounded without resistance. The extensions cover enlargement of the building to accommodate two additional generating units, one of which is now being installed, and for double high-tension and low-tension busses, and for six 25,000 volt. feeders. The new unit consists of a 2,810 kv.a., three phase, 60 cycle, 720 rev. per min. horizontal maximum-rated generator direct connected to a 4,000 h.p. turbine.

The success of this development depended upon the storage of the water of the Beaver River and for this purpose two large storage dams were constructed. From the head works, a wood stave pipe 46 in. in diameter conducts the water 3,400 ft. to the Johnson differential surge tank which is 105 ft. high. From this tank a 52 in. diameter steel pipe is carried 1,550 ft. to the power house, which is a brick building 69 ft. wide, 112 ft. long and 34 ft. high above the generator room floor. Actual tests made at this station after the first installation was completed in 1915 gave an overall full load efficiency of 80 per cent. which shows how carefully the design was worked out.

Additional power for the Eugenia system will be obtained, when required, by the construction of further water storage systems and of a second pipe line at the Eugenia Falls development and the installation of a fourth unit, also by the construction of a station on the Saugeen River near Lake Huron which, operating in parallel with the Eugenia Station, will make available a total output for the system of 15,000 h.p.

Three Systems Tied Together.

The Eugenia system comprises 245 miles of 22,000 volt. circuit (176 miles of lines) supplying substations at the points shown on accompanying diagram, and 50 miles of 4,000 volt circuits. This system is connected to the Severn system by means of a single-circuit, three-phase tie line from the Eugenia generating station to Collingwood, a distance of 24 miles. By means of this tie line and the tie line from Wasdell's Falls to Big Chute mentioned above, the Eugenia, Severn, and Wasdell's systems are paralleled. The generating station of the Town of Orillia on the Severn River at Swift Rapids near Big Chute is also connected into the Severn system.

Central Ontario System

Five main generating stations, one on the Otonabee River and four on the Trent River, all operating in parallel,

supply this system. These are now fully loaded and plans are being prepared for new stations near Campbellford to provide additional power. The five exciting stations were built by the subsidiary companies of the Electric Power Company. The following table gives the data relative to the existing developments, all generators being three-phase, 60 cycles, with 25 per cent overload guarantees:

Location	Gross head feet	Rated Turbine capacity h.p.	Type	Generator voltage
Trenton.	20	1400	Vertical	6600
Frankford.	18	1200	Vertical	6600
Campbellford . . .	23	1100	Vertical	2400
Healy Falls . . .	76	5600	Horizontal	6600
Auburn	18	950	Horizontal	2-6600 1-2400

In addition to the above stations, a 1000 kv.a., three phase, 60 cycle, 120 rev. per min. horizontal generator owned by the town of Campbellford in its generating station, a short distance north of the Campbellford station, delivers its output to the 2,400 volt bus in this station. Also at Fenelon Falls, a small generating station is operated, containing two 400 kw., 600 volt, three phase, 60 cycle, 200 rev. per min. generators connected to two 700 h. p. turbines. These feed into the 44,000 volt net work of the Central Ontario system at Lindsay the voltage being stepped up in the generating station through two banks of transformers to 11,000 volts for transmission to Lindsay. All these stations are on the route of the Trent Valley Canal the dams having been constructed by the Government of the Dominion of Canada.

Other power sites along the Trent Valley Canal will when developed, provide about 60,000 electrical h.p. with a maximum capacity of 75,000 electrical h.p. The present power output of the system is used for lighting, street railway and manufacturing purposes, a considerable quantity being required at Campbellford for a pulp and paper mill, and near Bellevil'e for cement mills. All transmission lines are constructed on wood poles. The total mileage of 44,000-volt circuits is 372, with 15 miles of 11,000-volt circuit, 16.4 miles of 6600-volt circuits and 52 miles of 4000-volt circuits.

St. Lawrence System

This system at the present time has no generating station owned by the Commission. Power is secured by contract from the hydraulic station of the M. F. Beach Company at Iroquois, but the amount obtainable proved inadequate and was supplemented by power obtained from the steam generating station of the town of Brockville. As additional power is needed arrangements are now being made to obtain an adequate supply from another source, near Cornwall. To take this power the Commission is now constructing a transforming station near Cornwall which will contain one bank of three 1250 kv.a., single-phase, 63,500/26,-400-volt, 60-cycle transformers connected star-delta and switching equipment for two incoming 110,000-volt circuits and for two outgoing 26,400-volt circuits. This system now supplies power to Brockville, Prescott, Morrisburg, Winchester and Chesterville.

Rideau System

A new net work is being developed called the Rideau system and covering a district in the neighborhood of the Rideau River. Plans are now being prepared for a hydraulic generating station at High Falls on the Mississippi River near Clarendon, a point about 50 miles northerly from Kingston, Ontario. The installation at this point will consist of four 350 k.w., 2200 volt. three-phase, 60-cycle, 300-rev. per. min. horizontal generators connected to two turbines, one generator being at each end of turbine; and one 875 kv.a. 80 per cent. power factor, three-phase, 60-cycle, 2200-volt, per min. generator direct connected to its turbine with necessary switching and transformer equipment to transmit the full 2,100-kw. output, at 26,400 volts to the Rideau system. A portion of this system is now in operation, power being obtained at 26,400 volts, three-phase, 60-cycles, under contract from the Rideau Power Co. at Merrickville, and transmitted to Smiths Falls where at the substation the municipality's own generating stations are paralleled with this system on the low-tension bus. This system may ultimately be connected with the St. Lawrence System.

Niagara System

The Niagara system comprises all lines and substations that receive power from Niagara Falls, and covers the entire district from Niagara River to the Detroit River and east to Toronto. Power is received at a transformer station at Niagara Falls from the Ontario Power Co. (now controlled and operated by the Commission) and from the Canadian Niagara Power Company, at 12,000 volts, three-phase, 25 cycles and is transformed to 110,000 volts and to 45,700 volts for transmission. There is now installed in the Niagara transformer station 132,000 kv.a. of 110,000-volt transformers in eight banks and 42,000 kv.a. of 45,700-volt transformers in four banks, not including spare units. Four banks of 110,000 volt units are composed of twelve 7500 kv.a., single-phase, shell-type 12,000/63,500-volt transformers, all other transformers being of 3500 kv.a. rating. This station, in point of transformers capacity, is the largest in the world, having a total capacity of 174,000 kv.a., with 7,000 kv.a. in spare units additional.

Four outging 110,000-volt circuits feed to Dundas transformer and switching station and from there power is distributed to thirteen 110,000-volt transformer stations. Four 45,700-volt lines feed to Welland to the substations of the Electric Steel & Metals Company, the Union Carbide Co. and the city of Welland. From this latter point a single-circuit, 45,700 volt line runs to Dunnville.

The transmission net work on this system contains 760 miles of 110,000-volt circuits; 65 miles of 45,700-volt circuits; 529 miles of 26,400-volt circuits; 489 miles of 13,200-volt circuits; 27 miles of 6,600-volt circuits; 180 miles of 4000-volt circuits; and 20 miles of 2,200-volt circuits. The 110,000-volt and 45,700-volt circuits are carried on steel towers (with exception of one 45,700-volt line from Welland to Dunnville), while the other circuits mentioned above are standard wood pole line construction.

The Commission in 1917 purchased the Erindale Power Company which had a hydraulic generating station on the Credit River at Erindale, 14 miles west of Toronto, containing two 600-kw. three-phase, 60-cycle, 13,200-volt. 200 rev. per min. generators, each direct-connected to a 1,000 h.p. turbine designed for a 60-ft. head. The present operating head is about 50 ft. The output of this station is transmitted to the Cooksville transformer station at 13,200 volts, 60 cycles, and is fed into the 13,200-volt, 25-cycle bus in that station through a 1000 kv.a. 60/25-cycle frequency changer set, augmenting the power supply on the Niagara system, and serving also to raise the power factor at the Cooksville station.

The generating plant of the Ontario Power Company, taken over by the Commission in 1917, contains 14 generator units, generating 12,000-volt, three-phase, 25 cycle power with a total rating of 149,012 kv.a. The Commission is now making extensions to the generating station. The building is being extended north about 90 ft. and a third pipe line of temporary nature consisting of wood stave pipe is being constructed. Two additional generating units are being installed each rated at 15,000 kv.a. maximum rating at 75 per cent. power factor.

These new generators are the same speed as the previous units namely 187.5 rev. per min. and the frames are the

same size as the 8775 kv.a. units most recently installed. They have, however, a higher temperature guarantee and are so designed that they may be operated as synchronous condensers at zero power factor if it ever becomes necessary to remove them from this station. These generators were made in Canada, under war conditions, and all parts, except the laminated steel and the insulation, were produced in this country. This speaks well for Canadian industry in these trying times.

The Ontario Power Company obtain some power from the Electrical Development Company's generating station at Niagara, this being brought into the distributing station on two 12,000-volt feeders. When the present extensions to the distributing station are completed, there will be six main bus sections connected together through reactors. Three of these bus sections will supply the power delivered to the 12,000 volt bus in the Commission's transformer station to which the feeders from the Canadian Niagara Power Company are also connected through a bus reactor. The concentration of generator capacity on this 12,000-volt bus is consequently very great and has necessitated material changes in the switching equipment and bus construction. The studies covering the installation of reactors on this 12,000-volt system have been most interesting. There is no 12,000-volt bus in the generating station, and each generator feeds through an automatic oil circuit breaker in the generating station to its individual cables in the cable tunnels up the hill, thence to its group of circuit breakers in the distributing station, where switching arrangements are such that each generator and each feeder may be connected to either of two bus sections. In the Commission's Niagara transformer station there is a single sectionalized 12,000-volt transfer bus system so arranged that feeders are connected through an auxiliary bus to the main bus or direct to a transformer bank.

It is of interest to note that the cables for the two new 15,000 kv.a. generators were purchased after laboratory tests were made on manufacturers' samples to determine the dielectric losses and tendency of compound to flow, and guarantees on dielectric losses were obtained from the contractor.

Another interesting point in connection with the feeders entering the Commission's transformer station is that eight of these are three-conductor, armored cables laid directly in the earth without ducts. These armored cables all have sector-shaped conductors, with 8/32-in. x 8/32-in. paper insulation, a lead sheath and a double steel tape armor with jute bedding and jute covering. They are placed three feet below the surface and two and three feet apart centre to centre. Where these buried cables cross ducts containing other cables, arrangements are provided to moisten the surrounding earth either by sprays above the surface or by porous tile in the ground.

The Queenston Development

When the Commission in March, 1908, contracted with the Ontario Power Company for 100,000 horse power, it was thought by many that such amount of power would meet the requirement for many years. This supply was however exhausted in 1915 that is, in 5 years from date of first delivery of power, and the additional power secured by arrangements with the Canadian Niagara Power Company has proved insufficient to meet the demands. It became necessary therefore to look to a new development to secure a further supply and the final decision was to proceed with a development called the Queenston Development which is authorized by an Act passed by Ontario Government in April, 1917, called The Ontario Niagara Development Act.

Between Lakes Erie and Ontario there is a difference in elevation of 330 feet. The greatest net head now utilized on the Canadian side at Niagara Falls is about 160 ft. Canada is entitled to divert 36,000 cu. ft. per second from the Niagara River, and of this amount, by an Ontario Government Order in Council in 1915 the Commission were allotted 6610 cu. ft. per second. The Ontario Power Company were allotted 11,180 cu. ft. per second, so that, within the control of the Commission, there is now available 17,799 cu. ft. per second.

To obtain the greatest amount of power from the water available, after careful surveys and studies, it was decided to locate the generating station just above Queenston, and to take water from the Niagara River, through the Welland River (reversing the flow in same) and canals encircling the City of Niagara Falls to Queenston. The first canal is now under construction and the accompanying map of the Niagara District, shows its location.

The total length of waterway from the Niagara River to the generating station site is about 12½ miles, 4¼ miles of this distance being in the Welland River, and the balance in an excavated canal The net effective head will be about 305 ft. and the first canal is normally designed for 10,000 cu. ft. per second at minimum low water.

The generating station will be located about one mile up stream from Queenston, in the Gorge, just at the end of the last rapids in the river. At this point the banks are steep and short penstocks only will be required. Provision is being made for extensions, and right-of-way for two additional canals has been purchased.

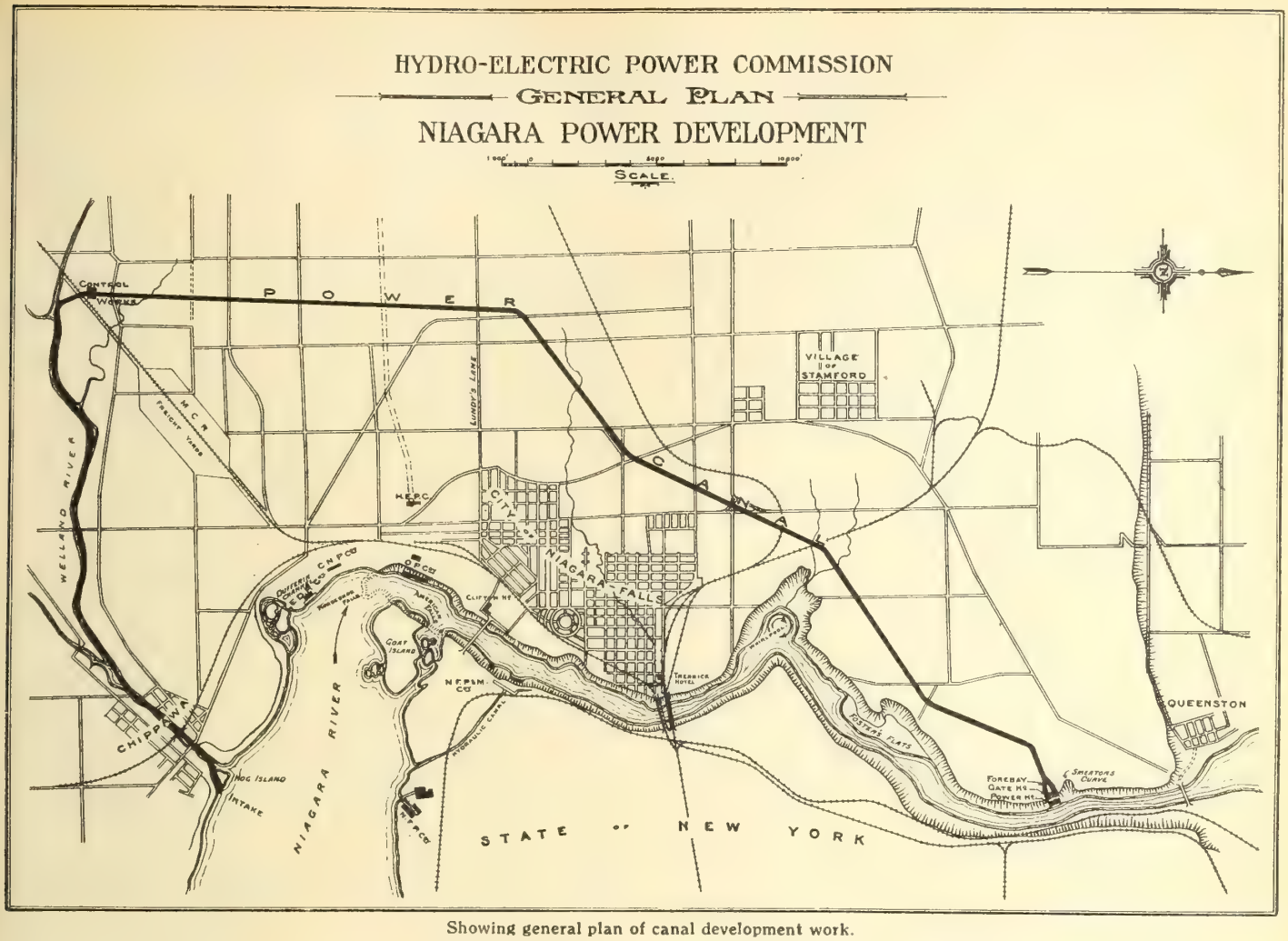
To show the effect of utilizing the greatest possible head of water, it may be pointed out that about 30 h.p. will be developed for each cubic foot per second in this development. whereas about 14 h.p. is all that is obtained in existing plants at Niagara Falls.

The development now under construction is designed as regards canal, forebay, gate house substructure and power house substructure, for a capacity of 300,000 h.p. It is proposed to construct the gatehouse and power house superstructure for an initial installation of 200,000 h.p. in four units. The designs are made so that extensions of power house and gate house can be made to almost any extent. Future plans contemplate the use of 100,000 h.p. units.

The turbine speed has been fixed at 187.5 rev. per min., and specification for the generators are now being issued calling for 45,000 kv.a., 85 per cent. power factor, 12,000 volt, three-phase, maximum-rated generators of vertical type equipped with thrust bearings to take the weight of the rotating part of the generator plus the downward thrust of the turbines. Direct-connected exciter mounted above the thrust bearings are proposed. The generators will be liberally equipped with embedded temperature detecters so that close and accurate observations may be kept of operating temperatures. The specified maximum temperature of any part of the generator at rated load is 100 deg. cent. with cooling air at 40 deg. cent. The ventilation problem for such units is of great importance, each unit requiring approximately 125,000 cu. ft. of air per minute. It is proposed to install double 12,000 volt sectionalized buses, banks of transformers consisting of three 15,000 kv.a., single-phase units, and to lay out the switching equipment so that one generator, one bank of transformers, and one outgoing high-tension line will be a unit. Bus tie reactors will be provided, and the short-circuit current will be limited to a value that can safely be handled on the circuits and circuit breakers.

It is proposed to install two small service generators to supply power required for the station services such as pumping, cranes, lighting, machine shop, ventilating, etc.

To carry on the construction work on this development it was decided to make as extensive use of electric power as possible. Two large electrically operated revolving shovels each fitted with an eight-cu. yd. bucket for earth excavation and of capacity to handle a five-ton bucket in rock were provided. The larger or these two shovels has a boom 90 ft. long and a dipper stick 80 ft. long, while the smaller shovel has a



Showing general plan of canal development work.

boom 80 ft. long and a dipper stick 58 ft. long. Each shovel has motors of a nominal total rating of 715 h.p. on a half-hour rating. Three shovels weigh over 300 tons each and have a capacity of 5,000 cu. yd. of earth per day. Five other electrically operated shovels are also provided, having bucket capacities ranging from ⅞ to 4½ cu. yd.

The railway equipment of the construction work includes 150 dump cars of 20 cu. yd. capacity each, six 40-ton steam locomotives and twelve 50-ton electric locomotives.

The electric power required for shovels, trains, air compressors, etc., is obtained from the Ontario Power Company's station and is transmitted over two overhead feeders to the Whirlpool Substation located near the Whirlpool. A similar substation will shortly be erected near Montrose on the southerly section of the canal. The Whirlpool substation is of semi-permanent construction and contains switching equipment for the two 12,000-volt incoming lines, and for three 1,500 kv.a., 12,000/4,000-volt transformers, four 500 kw. 600-volt, d-c. synchronous converters with their 12,000-volt transformers. An adjoining room contains eight air compressors of 1,000 cu. ft. per minute capacity each against 125 lb. pressure, belt driven from 550-volt motors, supplied through two banks of 200 kv.a., 2300/550-volt transformers. Air is distributed up and down the canal for a distance of three miles from this substation to operate rock drills, channellers and forges, etc.

Power is distributed up and down the canal by 4,000-volt, 25-cycle, three-phase, four-wire, grounded-neutral circuits to which the shovels are connected through flexible armored cable. A double track railway has been built for the full length of the canal with a branch to the main dumping point at St. Davids. These railway lines are electrified, the trolley wires being offset to one side of the track so as not to interfere with the shovels.

The substation at Montrose will be identical with that at Whirlpool and it will similarly serve to supply power for the work on the upper end of the canal.

The extensive use of electric power on the construction of works of the magnitude of this development is working out well and is resulting in a great saving of coal.

Electrification of Montreal Tunnel

By Mr. W. G. Gordon*

Following the discussion on Mr. Hull's paper, Mr. W. G. Gordon, Transportation Engineer of the Canadian General Electric Company, gave a very complete description of the electrification of the Montreal Tunnel zone. He explained that the tunnel is designed to provide at the same time an entrance for the Canadian Northern Railway System into the heart of the city and to render available a large area for residential purposes. As Mount Royal stood in the way of these two projects it was necessary to excavate a tunnel 3.1 miles long. This tunnel has a uniform grade of .6 per cent. towards the city. The paper described that different cross-sections were used, depending on the geological formation. The twin-section type of tunnel was used throughout.

Work was carried on from each end of the tunnel and also from a shaft sunk about a mile from the end known as the West Portal. When the headings on one side met, the lines checked within 1/16th inch on alignment and ¼

*Transportation Engineer, Canadian General Electric Co., before Toronto meeting A.I.E.E., November 22-23, 1918.

inch on grade, and on the other side the error was only ¾ inch in alignment and ¼ inch in grade.

Mr. Gordon explained the method employed in driving the tunnel, which was to drive a bottom centre heading about 8 feet by 12 feet wide from which the full-sized excavation was developed in a number of places. Four drills were used in each heading, supported on a horizontal bar and operated by compressed air at 100 pounds pressure, the aggregate capacity being about 11,000 cubic feet of air per minute.

The Montreal Light, Heat and Power Company supply power for the operation of the tunnel at 63 cycles, 3 phase, 11,000 volts. Direct current is provided by two motor-generator sets, each 750 kw., 1,200 volts, with an overload capacity of 200 per cent. for 5 minutes. The overload capacity is obtained by the use of a pole face winding; this winding of tubes and rods through holes near the pole faces is so connected as to directly oppose the armature reaction. In the paper, Mr. Gordon described all of the electrical eqiupment in detail.

There are at present six locomotives in operation, the motor equipment of each consisting of four GE-229-A, commutating pole motors wound for 1200 volts and insulated for 2,400 volts., two of the motors being permanently connected in series for operating on the 2,400 volt trolley circuit. This voltage is obtained by operating the motor-generators in series. Each motor is rated at 320 h.p. Mr. Gordon further explained the complete electrical equipment of the locomotives.

The speaker described at length the multiple unit motor cars at present in course of manufacture for handling local traffic. The principal dimensions of these cars are as follows:

Length over buffers	67 ft. 5¾ ins.
Length over body corner posts	57 ft. 6¼ ins.
Truck centres	42 ft. 9 ins.
Width over side sill angles	9 ft. 10½ ins.
Width over eaves	10 ft. 2¾ ins.
Height top of rail over roof	13 ft. 0 ins.
Height top of rail to underside of side sill	3 ft. 7½ ins.
Centre to centre of body side bearings	4 ft. 10 ins.
Centre to centre deck sills	5 ft. 6 ins.

The motor equipment of these cars consists of four GE-239-A, 125 h.p., 1,200 volt, commutating pole motors, insulated for 2,400 volts, two of the motors being permanently connected in series. The complete electrical equipment of the cars was also given in detail.

Mr. Gordon explained that special local conditions and temperatures introduced features which required a design of the catenary system somewhat out of the ordinary. The pantograph is of the sliding type and the conductor wire is of special bronze composition, size No. 0000 with a breaking strength of 65,000 pounds per square inch. Its section is the standard of the A. E. R. A. for No. 0000 grooved trolley wire. This wire was used in preference to hard-drawn copper, because of its longer life when subjected to the wear caused by the sliding pantograph, and also because it could be pulled up tighter than copper on account of its greater strength.

The article was illustrated throughout by lantern slides.

Canadian Independent Telephone Convention

The 13th annual convention of the Canadian Independent Telephone Association was held commencing November 20 with headquarters at the Carls-Rite Hotel, Toronto. A splendid attendance was recorded and the papers read and topics discussed were unusually bright. A resolution was adopted urging that, in cases where highways are being widened in connection with the Ontario Government's highway policy, the Government in all cases assume the expense incurred in moving poles and other equipment. Some of the papers read at the convention were as follows: "A Troubleman's Experience on a Rural Telephone System," by Dr. W. Doan, Harrietsville; "Financing a Telephone System," the local company, by James McEwing, Drayton, and the municipal system, by Francis Dagger, telephone adviser of the Ontario Railway and Municipal Board; "Increased Telephone Costs and Rates," A. D. Bruce, Stouffville, and "Keeping Books for a Local Telephone Company," by George Tait, Bridgeburg.

Officers Elected

The election of officers for the ensuing year resulted as follows: Honorary president, F. S. Scott, Brussels; president, Myron A. Gee, Selkirk; vice-president, A. McLean, Paisley; secretary, A. Hoover, Green River; treasurer, F. D. Mackay, Toronto. Executive—Col. T. R. Mayberry, Ingersoll; S. Suddaby, Burnt River; G. W. Jones, Port Hope; James McEwing, Drayton; Anson Groh, Preston; J. R. Forbes, Waterford; R. A. Harrison, Dunnville; C. J. Johns, Algonquin; F. E. Webster, Creemore; George Tait, Bridgeburg; W. R. Wadsworth, Byron; Dr. W. Doan, Harrietsville; E. E. Wilson, Caledon; P. R. Craven, New Liskeard, and Dr. A. N. Hotson, Innerkip. Auditors, George Tait and R. A. Harrison.

Bell Telephone Co. Asking Increased Rates

The hearing before the Board of Railway Commissioners in the matter of the application of the Bell Telephone Company of Canada for an increase in tolls and in the matter of the application of the municipal corporation of the cities of Montreal, Toronto, Hamilton and the Union of Canadian Municipalities for an order directing the delivery of particulars by the telephone company, is proceeding at Ottawa. The Bell company have submitted statements for the years 1913 to 1917, the following being the figures for the years 1913 and 1917:

	1913	1917
Gross operating revenue	$8,397,463.49	$11,179,162.07
Operating expense	3,214,564.73	4,545,328.05
Annual maintenance	1,549,978.25	1,595,366.19
Depreciation	1,660,000.00	2,470,000.00
Taxes	190,648.22	422,427.22
Other deductions:		
Total expenses	6,635,191.20	9,033,121.46
Net operating revenue	1,762,272.29	2,146,040.61

The total expenses from January 1 to September 30, 1918, were shown to be $7,483,739, and the net operating revenues for the same period, $1,552,653.

The total capital liabilities for the above period were shown to be $29,149,000, and the total current liabilities $1,258,266.14. The value of the company's lands and plants to September 30, 1918, book value, was shown at $43,200,362.77.

The estimated new revenue that would be produced by the proposed 20 per cent. increase, according to the statement, is $1,200,000. Summarized the statement shows:

Exchange revenue	$1,200,000
Long distance revenue	20,000
Service connection charges	115,000
Moving and change of name charges	125,000
Total new revenue	1,460,000

Additional statements were furnished by the company, bearing on maintenance charges, etc.

A recent court decision in Toronto was in favor of a woman who was said to have sustained internal injuries as the result of a fall when a strap, to which she was holding in one of the cars of the Toronto Street Railway, broke. The jury, under Chief Justice Meredith, were of the opinion that the company was negligent in not maintaining the strap in a safe condition and that $1,000, in the way of damages, would go far toward alleviating the plaintiff's suffering.

110,000 Volt Transmission Line Over the St. Lawrence River

By Mr. S. Svenningson*

The Shawinigan Water & Power Company has for a number of years been transmitting power from the generating plants at Shawinigan Falls located north of the St. Lawrence River about 20 miles from Three Rivers, one branch running to Sherbrooke and supplying various towns and industries between, the other branch feeding the asbestos mines and other industries in the Thetford district. The current is transmitted at 50,000 volts from Shawinigan Falls to the St. Lawrence, where the voltage is stepped down to 25,000 for transmission across the river over the submarine cable, then stepped up to 50,000 volts and transmitted at this voltage to Thetford and Sherbrooke.

At the time the submarine cables were installed, the alternative of putting in an overhead crossing was considered but the amount of power to be transmitted at that time was so small that it was decided that the expense of an overhead crossing was not warranted. However, the demand for power on the south shore steadily increased, until by the beginning of 1916, five submarine cables were in operation, two three-phase and three single-phase, and the capacity of the transformer house, 10,000 kw., had been reached.

Submarine cables have always been a weak point in this part of the system and a source of more or less trouble and expense. The current in the river carries them down stream and is sometimes strong enough to pull them apart. In the winter the ice has often put them out of commission, and it has been found necessary at times to erect temporary pole lines across the ice to maintain the service to the south shore. When, therefore, in the Fall of 1916, the demand came for more power for the south shore, partly for war work, and it became a question of putting in an additional submarine or an overhead crossing, the Company decided in favor of the latter.

The construction of an additional submarine crossing would have involved an expenditure of about $150,000 for the purchase and installation of the cables, additional transformers, about 4000 kw. capacity, together with their switches, lightning arresters, etc. and the necessary extension of the transformer houses. Besides this, the weak point in the line would not have been improved.

The overhead crossing was estimated to cost $200,000 the difference between the two being offset, in the opinion of the company, by the elimination of the weak link, in obtaining greater security from interruptions to the service, and a gain of from 2 per cent. to 3 per cent. in regulation by cutting out the transformers together with the elimination of a considerable amount of operating and maintenance expense. The transformers and other equipment were needed and could be used to advantage in other parts of the system.

Preliminary Investigation

The two shores of the St. Lawrence River upstream, as well as downstream of the cable houses were carefully surveyed in order to find the most advantageous point of crossing. As a result of this preliminary survey it was finally decided to investigate in detail two alternatives:

a. A three-span crossing at Point-du-Lac, each span approximately 2,200 ft long.

b. A single-span crossing between the cable houses 4,800 feet long.

From a construction point of view the site at Point-du-Lac, about six miles up the river from the cable crossing appeared at first to be very favorable for an overload crossing. The St. Lawrence at this point is about 7,000 ft. wide, but as the water is very shallow, except for a distance of 2,000 ft. in the centre, a crossing could have been built using three spans of approximately 2,200 ft. each. The towers on either side of the main channel would have been about 205 ft. high, while the other two towers would have been about 110 ft. high. Although this alternative probably would have been somewhat cheaper, i.e. the cost of the crossing itself it would have necessitated the building of about 15 miles of double-circuit high tension pole lines in order to connect up with the main transmission lines. This additional cost would have brought the total cost approximately up to that of the single-span scheme. A fairly strong point against the three-span crossing was the inaccessibility of the towers during certain periods in the spring and fall when the river is full of floating ice. The single-span scheme was finally decided on as being the most advantageous, although it was fully realized that there were many difficult problems to solve in connection with the design and construction.

General Description

The crossing as completed consists of a central span 4801 ft. long and two anchor spans, the north shore span 571 ft. long and the south shore span 951 ft. long.

There are two towers 350 ft. high and 60 ft square at the base, the upstream and downstream faces tapering to a width of 14 ft. at the top. A cross-arm at the top, 14 ft. wide by 100 ft. long, carries three double-groove sheaves 8 ft. in diameter and 50 ft. apart, over which the anchor cables pass. The tower foundation is made up of four circular reinforced concrete piers 11 ft. in diameter placed on the corners of a 60-ft. square. These piers are connected by heavily reinforced concrete beams 4 ft. wide by 8 ft. deep.

Three lines of cable 50 ft. apart span the river between the two towers. The cables are 1⅜ in. in diameter made of galvanized plough steel. They are composed of six strands of 19 wires each and a stranded core of 30 wires. To each end of the centre span cables is yoked two anchor span cables. These are carried over the tower on the 8-ft diameter sheaves and then down to a point about 20 ft. from the anchors. At this point equalizing beams are cut in the lines and the load is transmitted from this point to the anchor piers by means of short straps of 1¾ in. diameter cable. The cables are gripped at the end by means of heavy steel bridge sockets in accordance with the usual practice for suspension bridge cables and other structures of this type.

It was originally intended to use the main cables as conductors and to insulate them from the tower by specially designed insulators. Unfortunately these insulators were not completed in time for erection, and for the present the main cables are used as messengers from which No. 1/0 stranded copper conductors are suspended. These suspended lines are supported every 250 ft. by suspension insulators of eight units to a string.

The anchor piers are large mass concrete "dead men,"

* Designing Engineer, Shawinigan Water & Power Co., before Toronto meeting A. I. E. E.

being designed to take the full overturnig moment when submerged

Foundations

During February, 1917, a number of borings were taken at the site of the towers to determine the nature of the river bottom. These borings penetrated to a depth of 100 ft. and we found that the foundation on which we would have to build out towers consisted for the full depth of these borings of very fine white sand with occasional strata in which a little clay was mixed with the sand. The difficulty of obtaining a secure pile foundation in this kind of soil and the uncertainty as well as the cost of placing a mat foundation in the dry, led us to adopt the form of pier foundation which we used.

The piers were constructed in the form of hollow cylinders of reinforced concrete with an outside diameter of 11 ft. and an inside diameter of 7-ft. These cylinders or caissons were poured in 6-ft lifts, the first lift tapering on the inside towards the bottom to a diameter of 10 ft. and being shod with a 6 by 6-in. angle cutting edge. This lift was poured on the working platform and lowered into the water by means of four two-in. screws. The second lift was then excavated by means of an orange peel bucket rigged up on a derrick. As the caissons gradually settled successive lifts were poured until they had penetrated the bottom to a depth of about 40 ft.

Little trouble was experienced on the north side, but on the south side we encountered large numbers of boulders, some of which were so large that they could not be picked up by the bucket, so that we had to drill and shoot them. In order to do this the caissons had to be unwatered, a tedious process which delayed the work considerably. When a caisson had reached its penetration of 40 ft., a plug of rich concrete was poured in the conical section at the bottom and the inside was then filled with mass concrete. The four piers forming one foundation were finally connected by reinforced concrete beams.

This work was begun early in the year and we expected to have it finished by mid-summer, but high water, high winds, rain and labor troubles delayed us so much that it was not completed until about the middle of September.

Cables

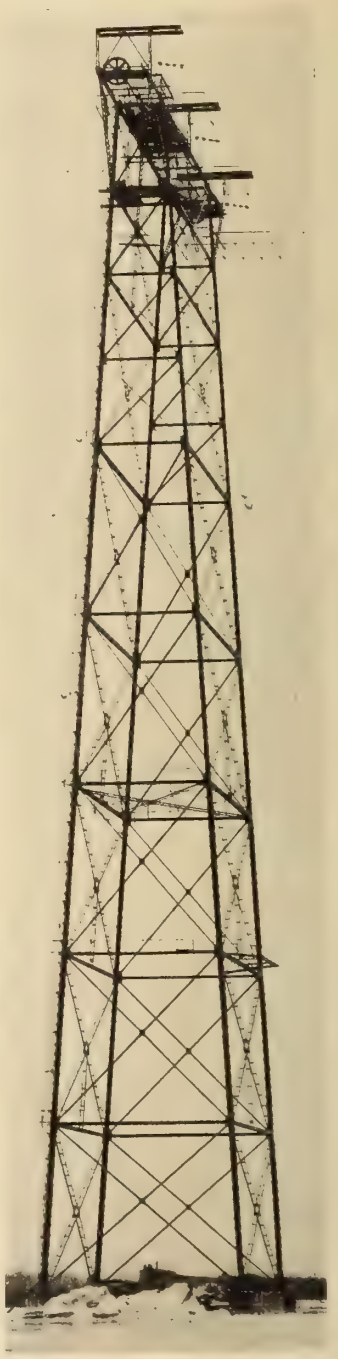
The cables are 1⅜ in. in diameter, of galvanized plough steel, made up of six strands of 19 wires each, and a stranded steel core of 30 wires. Tests made at McGill University showed that the wires had an average yield point of 221,000 lb. per square inch, and an average breaking load of 258,000 lb. per square inch.

The completed cable was tested, the yield point being found to be 158,500 lb. and the ultimate strength 186,400 lb. or 193,000 lb. per square inch, and 227,000 lb. per square inch respectively.

The test of the completed cable, indicated a modulus of elasticity of 7,250,000 lb. or 8,800,000 lb. per square inch. We were in doubt as to the correctness of our test in this regard on account of the fact that the usually accepted value for the modulus for stranded steel cables is about 21,000,000 lb. per square inch. However, the behaviour of the cable during erection bore out the results of the test.

The bridge sockets used for connecting the cables were machined out of solid blocks of steel so as to allow a grip of nine in. on the cable. The cable was passed through a tapered hole in the centre of the bridge socket and broomed out on the end for a length of 15 to 18 in. The wires were then cleaned with gasoline and held in place by means of a templet made of ⅛ in. steel plate which fitted over the back of the bridge socket. The bridge socket was suspended bottom up and heated by gasoline torches for about half an hour, when spelter was poured into the conical hole through a one in. diameter hole in the centre of the templet. After being allowed to cool, the ends of the wires projecting from the templet were cut off and the templet was removed.

Before adopting this form of connection, tests were run under our direction at McGill University to determine the depth of socket required. We found that if the spelter was heated to just the right temperature, i.e., just hot enough to ignite a sliver of wood thrust into it, that the full breaking strength of the wire was, in the majority of cases, developed in a length of six inches.



North tower, St. Lawrence River Crossing, showing copper conductors leading from strain insulators on messenger cable through main tower.

Shortly after the bridge sockets were poured it was found necessary to shorten two of the cables and the speltered end was cut off. We had one of these cones of spelter cut in the

machine shop and found that the spelter adhered so firmly to the wires that the section could be machined without lifting the wires out.

Insulators

The insulators which we propose using eventually in the steel line were devised by our engineering department in conjunction with that of the Canadian Porcelain Company. They consist of a large ring-girder and two spiders.

The ring-girder is eight ft. in diameter and made up of two nine in. channels 12 in. apart, with ⅜ in. cover plates. The upper spider is connected to the ring-girder by means of three 2½ in. bolts 10 ft. long, one at the end of each spider arm. The centre spider is supported on the ring-girder by six porcelain insulators of eight skirts each, two insulators at the end of each spider arm. The clear distance between the spiders is about 36 in.

The porcelain insulators used are special compression insulators having a tested breaking strength of 60 tons each, this is about four times the estimated maximum load. Electrical tests showed a dry flashover of 302,000 volts and a wet flashover of 262,000 volts.

The completed insulator has a net weight of about 6 tons.

Erecting Cables

Owing to a constant succession of delays that occurred in the construction of the foundations and the erection of the towers we had to abandan our original plan of stringing the cables in the Fall of 1917 before the ice formed in the river, and so decided to do this part of the work after the ice had become thick enough to support the weight of the heavy reels of cable.

Throughout the heavy snows of January and February we managed by constant rolling and scraping to keep a road open between the two towers. Early in March the centre span cables were laid out along this road. The anchor cables were then laid out, measured, and cut and their bridge sockets attached.

The three lines were erected one at a time, the middle line first and then the downstream and the upstream lines in succession. The ends of the anchor cables were hoisted over the towers, the south shore cables were hoisted over the towers, the south shore cables made fast to the centre span cable, drawn over the tower until the bridge sockets touched the main sheave, tied to the top of the tower and attached to the anchor pier. The north shore cables were next attached to the centre cable, the suspension insulators and copper line fastened to this and the cable hoisted into place.

The hoisting was done by a steam hoist braced against the centre anchor pier. Two ⅝-in. steel hoisting lines reeved through the two pairs of three-sheave blocks were used to draw the end of the cable up to within 40 ft. of the anchor pier, the final 40 ft, being taken up by means of two ¾-in. steel cables reeved through two pairs of six-sheave blocks.

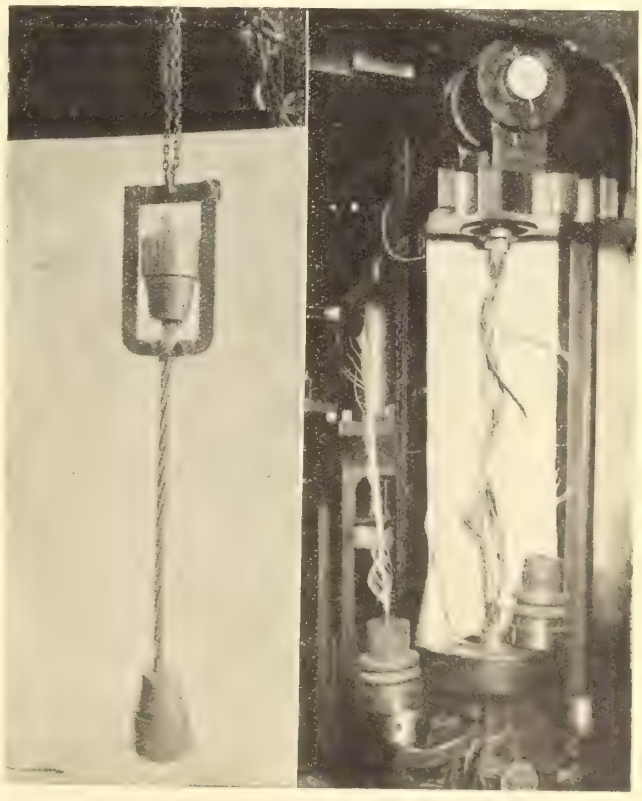
The copper conductor in each line is supported by seventeen suspension insulators spaced about 250 ft. apart, the end insulators being about 400 ft. from the towers. The copper lines drop from the end insulators to strain insulators on the tower at the 150-ft. level, pass through the tower to the back where they are connected to another set of strain insulators. On the north side, the lines pass direct from the main tower to a transmission line tower on the shore, a distance of about 600 ft. On the south side a light structural steel truss, 50 ft. long, hung from two sets of the anchor cables, provides an intermediate point of suspension, forming two spans of 500 ft. each. Access to the insulators attached to the truss is provided by a walkway running up from the anchor pier and suspended from the anchor cables.

After the cables were erected we noticed an almost constant vibration in them, varying in intensity and somewhat similar to that in a violin string, with definite nodes 12 to 15 ft. apart as nearly as could be judged. About a month after the line was put into service this vibration managed to shake loose the bolts connecting two of the suspension insulators to the cable and they dropped and hung suspended on the copper line. Two of the riggers volunteered to go out on the steel cable, fish up the insulators and attach them again. A trolley was rigged up and they had little difficulty in getting out to the point from which the insulators had fallen, about 1,000 ft. out from the tower. By means of a small tackle line they hauled the insulators back into place and started back towards the tower only to discover that the grade in the cable was so great that they could not pull themselves up. They solved the difficulty by looping the tackle line that they had with them over the steel cable and sliding down the 250 feet to a boat waiting below. A short time later an insulator on one of the other lines broke loose and it was similarly reconnected. This time, however, we profited by our former perience and provided a tail line by means of which the riggers were pulled back to the tower. Since then we have experienced no trouble from this source.

The cables, as originally strung, allowed the following clearances between the copper conductors and the average water level during the season of navigation:

Down stream	172.5 ft.
Centre	178.8 ft.
Upstream	180.6 ft.

The temperature at time of erection was about 20 deg. fahr. As there is a change in sag of approximately one ft. for each 10 deg. change in temperatuure the above would correspond roughly to clearances at 110 deg. fahr. of 163.5, 169.8, and 171.6 ft. respectively.



Cable test—Sample of cable with grips attached. Elastic limit 158,500 pounds; ultimate strength 186,400 pounds.

At the time these cables were erected we naturally expected the sag to increase as the cables stretched under the load until the strands were drawn tightly together. There was no data available with regard to the amount of stretch to expect so that it was impossible to allow for this in sag-

ing the cables. The hoist, therefore, was left in position so that we could pull up the cables when the sag became too great.

In May of this year we found that the sag in the cables had increased by from 24 to 27½ ft. and that in order to obtain the necessary clearance over the channel we would have to take up 34 ft. in the sag of the down-stream cable and 13 and 14 ft. in that of the centre and upstream cables respectively. The amount by which a cable is to be stretched in order to take up a given amount in the sag varies inversely as the modulus of elasticity of the cable.

Owing to the low modulus which we worked out for the cable from results of the tests made at McGill University we were in doubt as to the amount of take-up required. We found that in order to take up 24 ft. in the sag we would need to pull the downstream cable in between 7.2 and 10.4 ft. depending on the value of this modulus. This cable was taken in about 8 ft. with a consequent reduction in the sag of about 25 ft. This corresponds to the result that would be obtained if the modulus of the cable were 17,000,000 lb. In other words it would appear that from the time of the original sagging of the cable to the time the cable was resagged, the modulus of elasticity had increased from 7,250,000 lb. to 17,000,000 lb. This change in modulus is no doubt due to the gradual stretching of the cable causing the wires and strands to draw more closely together under the constantly applied tension of the span.

Ice Protection

Ice conditions in the St. Lawrence River at this point are at times very troublesome, and we considered it advisable to construct some kind of guard piers outside the towers, to obviate the possibility of damage from this source. During the winter we deposited about 3,000 tons of field stone on the river bed on each side about 75 ft. from the up-stream and river faces of the towers, carrying the rock to an elevation about three ft. above the surface of the ice. The ice usually goes out about this level, but last year conditions were exceptional, and before the ice moved it had risen above the tops of our ice breakers, and passed clear over them, piling up around the tower foundations to a height of 25 or 30 ft. Fortunately no damage was done. We are at present completing the guard piers, by means of reinforced concrete cribs filled with rock, and carried to about the level of the maximum recorded high water.

Sag Calculations

In our calculations for sags, tension, length of cable, etc., under various conditions, we used the parabolic formulas in preference to the hyperbolic formulas for the catenary on account of the greater simplicity of the former. Comparison was made however, between the two sets of formulas and we found, as we had expected, that at working tensions the difference was negligible. The formulas for the parabola gave us about six in. more sag, and about one ft. less length of cable than the catenary formulas for the same conditions of tension and temperature.

The maximum load on the cable, we assumed to be ¾ in. of ice all round, and ten lb. of wind per square foot of projected area for both the steel and copper lines, at a temperature of zero deg. fahr. Under these conditions the calculated tension in the cable is about 106,000 lb. with a sag of 228 ft. The normal tension at summer temperatures is about 61,000 lb. with a sag of 185 ft.

Conclusion

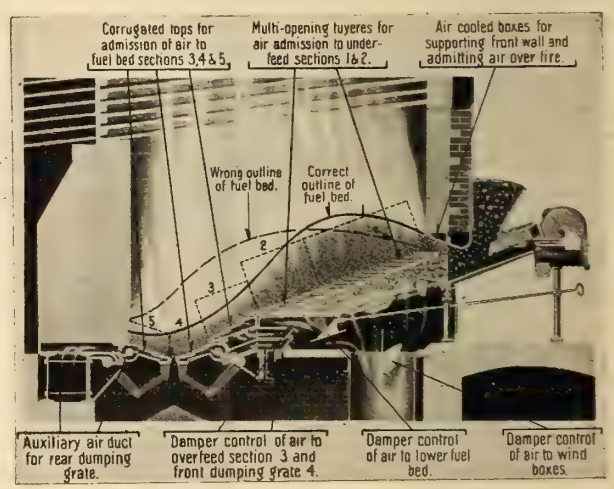
In our design, we always kept in view the accessibility of various insulators and other working parts that are subject to break down. Automatic hoists have been provided in the towers, as well as ladders which run from top to bottom and provide access to the suspension insulators at various levels.

The crossing has been in uninterrupted service now for about nine months; it has not yet weathered a winter with its low temperatures, gales and sleet storms, so that we still have something to learn about its action under these conditions, but as the allowable stresses have been kept within reasonable limits, we hardly expect serious trouble from this source.

Prevent Smoke and Save Coal—Boiler Room Instruments Help Save Fuel

Just now every practical suggestion along the lines of fuel conservation is a matter not only of personal comfort but, what is vastly more important, of the national welfare. Naturally the best place to save coal is the place where it is being used, and the boiler room offers a fruitful field for the exercise of fuel economy. The following summary of the experience of the combustion engineers of the Westinghouse Electric & Manufacturing Company, as gained from their own experiments and their observations of practical operation in customers' boiler rooms, will therefore be of value.

The formation of smoke, which contains much unconsumed fuel, should be prevented by proper firing methods and the flue gases should contain from 10 to 12 per cent. of CO_2. Fires should be kept free from holes, and the fuel should be so distributed over the grate as to prevent the influx of excess air which accompanies thin fires and the incomplete combustion resulting from excessive thickness of fires. The proper fuel distribution for a given type of stoker is illustrated in the accompanying figure.



Gauges which indicate boiler operating conditions should constitute a part of the equipment of every boiler room. As a minimum, the instrument equipment should consist of draft gauges connected with the furnace above the fuel bed and on the boiler side of the flue damper, and a steam flow meter for each boiler. Gauges and dampers should be conveniently located, otherwise they will not be used.

The loss due to the presence of unburned fuel in the ash should be avoided, boiler settings should be kept air-tight and baffles in proper condition, and under no condition should live steam leaks be tolerated. Exhaust steam should be used in place of live steam for auxiliary purposes wherever practicable. All steam pipes should be insulated and the tubes kept free from soot and scale. The size of the coal has much to do with the capacity and efficiency of a boiler. In general, the air pressure penetrates a fuel bed formed of coarse fuel more readily than one formed of finer coal, producing greater disturbance of furnace conditions and lowered boiler efficiency.

Canada's Heritage in the St. Lawrence River

By Mr. Arthur V. White, M. E.*

About a year ago, when I had the pleasure of addressing the Electric Club, as you may recall, we traced the evolution of the circumstances associated with power development on the Niagara River, and noted how those circumstances led up to the ratification of what is known as The Boundary Waters' Treaty of 1910, between Great Britain and the United States, and to the formation, under the treaty, of the International Joint Commission, This treaty now largely governs the development and use of boundary waters, and is of great importance in connection with the subject before us to-day because it constitutes the chief legal agency—so to speak—for safeguarding the interests of the people, of both the United States and Canada, in the international St. Lawrence River.

In proceeding, it will, I believe, be profitable first to point out how it is that even a recent treaty like the Boundary Waters' Treaty sometimes fails to provide that effective protection to either one country or the other, which it had confidently been expected would be found actual and full. I shall illustrate by reference to some issues which have arisen under the Treaty and to some arguments advanced under discussion of these issues.

Let me here comment, that the best safeguard the citizens of Canada can have in matters affecting their natural resources, is an intelligent understanding of the real value of their assets and of the best uses to which they may be applied, coupled with a quick and discerning appreciation of what constitutes any menace to these interests, and of how to act promptly for its removal. Menace to public interest often manifests itself in obscure and subtle forms.

Let us proceed to consider a few illustrations which, owing to limitations of time, can here only be referred to suggestively:

St. Croix River Application

The boundary line between the State of Maine and the Province of New Brunswick passes along the St. Croix River —a stream of considerable size. Four or five years ago United States financial interests controlling the St. Croix Paper Co. of the State of Maine, and operating in Canada through the Sprague's Falls Manufacturing Co., Limited—a company with a Canadian charter—undertook to increase the power installation which they already had upon the St. Croix River by erecting a new plant in the vicinity of what is known as the Grand Falls, situate about ten miles above Woodland, Me. The additional installation was to consist of 12,000 to 14,000 h.p., to develop which the company constructed a large canal lying and extending for nearly a mile entirely within the State of Maine. By means of a dam erected across the International Boundary at Grand Falls a lake was created so as to enable the water of the St. Croix River to be diverted by the canal into the United States for the development of power at the Grand Falls power house. This canal is so constructed that, at its lower stages, the total flow of the St. Croix River—an International Boundary stream—may be diverted into the United States. This company, after constructing their works, came before the International Joint Commission, pleaded ignorance of the law, drew special attention to their vested interests, and were finally granted a permit to utilize the works under terms greatly to their advantage.

Now, the Treaty provides that, after its acceptance, no diversion from boundary waters, whether "temporary or permanent," shall be made without obtaining the necessary authority. When the St. Croix case was under discussion, counsel suggested that the word "temporary" might not mean temporary with respect to time, but temporary with respect to place. That is to say, that the diversion of the St. Croix River was not out of accord with the treaty because the river was only diverted temporarily; that is, it was "temporarily" turned aside for a short distance and then resumed its normal course.

Navigation in Lake Michigan

Consider the next illustration: The Boundary Waters' Treaty defines boundary waters as "the waters from main shore to main shore of the lakes and rivers and connecting waterways, or the portions thereof, along which the International Boundary between the United States and the Dominion of Canada passes, including all bays, arms, and inlets thereof, etc." And the treaty also states: " It is further agreed that so long as this treaty shall remain in force, this same right of navigation shall extend to the waters of Lake Michigan and to all canals connecting boundary waters and now existing or which may hereafter be constructed on either side of the line."

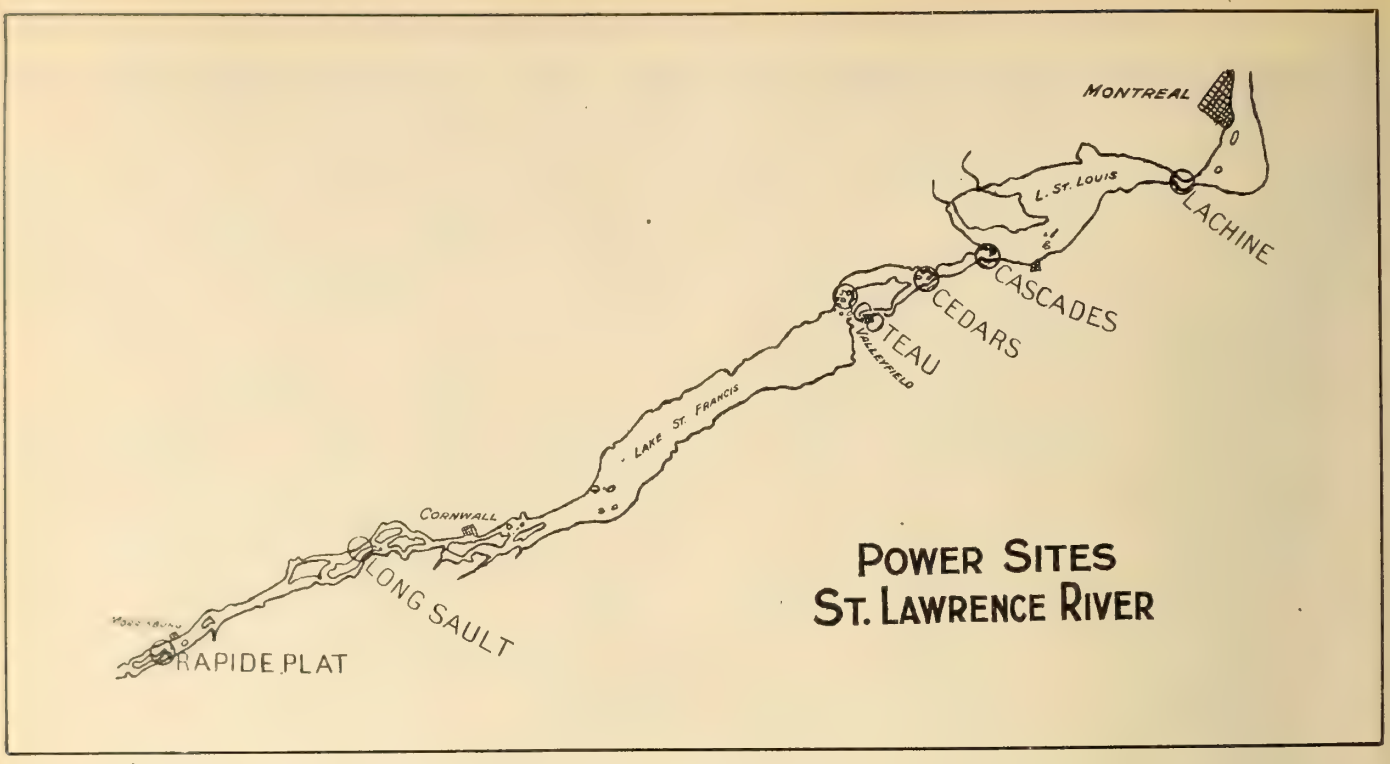
Now, the treaty, subject to certain restrictions, stipulates "that the navigation of all navigable boundary waters shall forever continue free and open for the purpose of commerce to the inhabitants and to the ships, vessels and boats of both countries equally," and one not acquainted with possible interpretations suggested for portions of the treaty, is naturally surprised to learn that it has been contended that Lake Michigan is not a boundary water—although a geographically corresponding body of water in Canada, the Georgian Bay, is such—and the treaty suggests, inferentially, that Lake Michigan is only conditionally open to navigation, while Georgian Bay—the Bay is not specifically mentioned—is open, but not conditionally open as in the case of Lake Michigan. Besides, assuming that the uninviting project of the Georgian Bay Ship Canal ever materialized, this canal, under the treaty, would be as equally free and open to the United States as to Canada. Of course, I am not arguing one way or another upon the points cited in my illustration, and I am passing over any reference to rights still existent under earlier treaties. I am simply suggestively pointing out certain facts which have been disclosed, and indicating certain contentions which have been offered, when subjects involving treaty terms have, variously, been considered.

Water Diversion from Niagara River

Take another illustration: The Boundary Waters' Treaty, in Article V., deals specifically with the diversion of waters for power purposes from the Niagara River, and provides that "so long as this treaty shall remain in force, no diversion of the waters of Niagara River above the Falls from the natural course and stream thereof shall be permitted except for the purposes and to the extent hereinafter provided."

When, during the last few years, certain interests desired to utilize a portion of the waters now flowing in the lower Niagara River, that is to say, below the Falls, the claim was urged that such waters could be used without coming before the International Joint Commission for permission, because it was contended that the treaty only dealt with diversion of water above the Falls and did not specify where the water should be returned. In other words, some interests hold that, under Article V., the International Joint Commission has no jurisdiction to deal with any diversion in the Niagara River other than with diversion made from "above the Falls." The water, it was argued, could be taken

*Consulting Engineer, Commission of Conservation, before The Electric Club of Toronto.

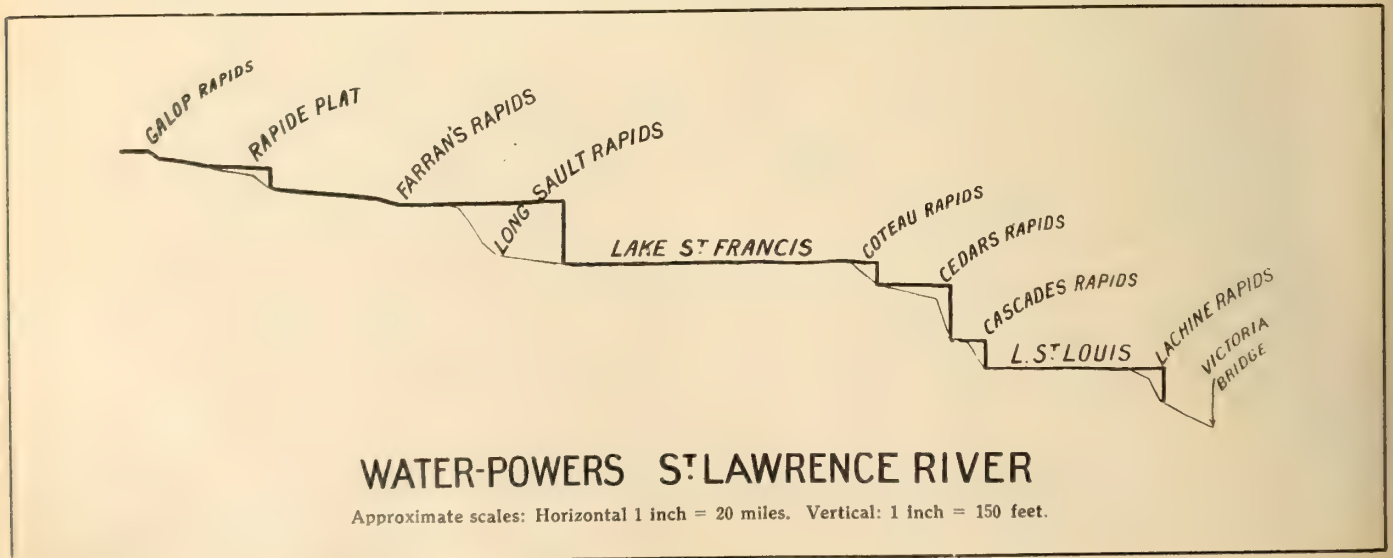


out above the Falls and turned, if users so desired, directly into Lake Ontario without coursing the lower Niagara River.

Application of St. Lawrence River Power Company

While illustrations might be multiplied, we shall here consider only one other instance. This arose during the past summer in connection with the application of the St. Lawrence River Power Company respecting the construction of works in the vicinity of, and the diversion of waters from, the Long Sault Rapids. The St. Lawrence River Power Company is a subsidiary company of the Aluminum Company of America, which, amongst other activities, operates a large aluminum-producing plant at Massena, N.Y. The St. Lawrence River Power Company desired to construct works in the St. Lawrence which would, so far as possible, remove ice difficulties which affected their winter output. To this end they excavated, largely in rock, a long channel, 25 feet deep by 150 feet wide, in the bed of the St. Lawrence River. Complementary to this excavation there was to be a large boom held by rock-filled cribs, some 30 feet square, sunk in the St. Lawrence River. Below the dredged channnel just referred to, there was also to be constructed in what is known as the South Sault Channel—that is, the passage nearest the United States' shore—a "submerged weir," which, actually, is a large submerged dam. The work of channel excavation was undertaken, and practically completed under permit from the United States War Department, without the matter in any way being brought to the official attention of the Canadian authorities.

The Boundary Waters' Treaty provides that there shall not be "any interference with or diversion from their natural channel of such waters on either side of the boundary" as will result in any injury on the other side of the boundary. If the enlarged channel remained, then the proposed submerged weir had to be constructed in order to compensate for alterations in level already resulting from the excavation. Incident to the construction of this weir the company deemed it desirable to obtain the approval of the International Joint Commission. Consequently, an application was made for hearing before the Commission. The company and the United States Government authorities stated that as a "war measure" it was necessary that the company be supplied with more power in order to produce more aluminum. The Com-



mission was urged to deal with the application of the company without delay and to waive rules of procedure which constitute the usual safeguards so far as the public is concerned. This course was urged although the company knew at least about a year before it made the application that the proposed dam would be necessary. Upon the war necessities Canada, of course, guaranteed every possible assistance and despatch.

In passing, I would like to remark that at times when certain issues have been under consideration before the International Joint Commission, and it appeared advantageous to interested parties to show how what might be done in boundary waters on one side of the boundary would affect the level of waters on the other side, it has sometimes been instanced that even a pile driven in a stream on one side would affect the level of water on the other. In the case of the large channel to which reference has just been made, which substantially affected levels in the river and adversely affected Canadian navigation, counsel for the applicant company argued that interests would really not be disadvantageously affected because when the large cribs and the dam was in place disturbed levels would then be restored.

Under the Webster-Ashburton Treaty it is specifically provided that the channels in the St. Lawrence River on both sides of Long Sault, Barnhart and Croil islands were to be kept "free and open to the ships, vessels and boats of both parties." So that, in any event, if the South Sault Channel were blocked by a dam, a navigable channel which was to be kept open by treaty right would be closed, and a public liberty and right which could not be justified under the spirit and intent of the treaty would be enjoyed by private interested parties.

Now, although the construction of the works referred to was, in the judgment of many, a violation of the spirit and terms of the treaty, the company, nevertheless, aided by their representations respecting the allies' war necessity, were able to obtain a permit to construct this dam and to have it remain in place for five years or for the term of the duration of the war, whichever term should be longer. You will notice it was not specified which term should be shorter. At the time of hearing before the International Joint Commission the solicitor-general of Canada, the Hon. Hugh Guthrie, on behalf of the Government of Canada made a special, solemn and very able protest against the granting of the permit except under conditions which he outlined, and which, while meeting temporary needs, would fully preserve the integrity of what he contended to be Canada's rights under the Webster-Ashburton Treaty.

From the foregoing illustrations it will be evident how necessary it is for our leading public men, especially those in Parliament, to have a good understanding of Canada's natural heritage in boundary waters and of means which must be taken properly to conserve this heritage for the benefit of her citizens.

Navigation of St. Lawrence River

We shall now consider, very briefly, some more concrete aspects of the subject which to-day has our chief attention: "Canada's heritage in the St. Lawrence River."

First, just a few words with respect to navigation. The St. Lawrence as the wonderful water highway from the Great Lakes to the sea has, as you know, been improved chiefly by the canal systems of the Government of Canada. The new Welland Canal is being constructed with locks of 30 feet draught. If it is to be used so that deep-draft, ocean-going vessels may go up to the head of navigation of the Great Lakes, then the St. Lawrence River in portions of its main channel will have to be canalized by means of a series of dams with suitable locks. If the river as a whole be canalized, obviously the water-power of the river would be most economically developed by having the dams necessary for the navigation improvement made adaptable also for the development of water-power. One fact is certain, and that is, that, in order to conserve the integrity of the St. Lawrence River so that it may suitably be canalized—when the time comes for such work—its integrity must not be compromised by permitting the erection of structures in the main stream for piecemeal development of power, although this has already been done to some extent. Naturally, there is a great temptation for water-power companies to do on the St. Lawrence as has been done elsewhere, namely, to make the cheapest possible preliminary developments—skim the cream off the powers, so to speak—for by so doing interests may readily acquire markets, and vested rights, and often control of the general situation.

I shall not further refer to Canada's heritage in the navigability of the St. Lawrence. In a word, it may be summed up that deep-craft navigation from the Great Lakes to the sea involves, absolutely, the treatment and canalization of the St. Lawrence River as a unit.

Water-Powers of St. Lawrence River

Coming next to the heritage of water-powers, I would remark first that the water-powers of the St. Lawrence River are, as yet, largely within the control of the people. The recent shortage of hydro-electric power which has been so keenly felt, both in Canada and the United States, has drawn increased attention to the enormously advantageous powers in and adjacent to International Boundary waters. Most of the water-powers which are more readily capable of economic development in Canada as well as in the United States either have already been developed or are privately controlled. Concentration of ownership is a noticeable feature of this control. Canada cannot afford to have her St. Lawrence River powers pass into the hands of powerful private interests.

Some Governing Factors

With respect to development of these water-powers, there are some very important points upon which I must just comment, such as ice conditions, the exportation of Canada's share of electrical energy and the character of the agencies utilizing the power.

Respecting Ice.—Power development on the St. Lawrence River cannot properly be considered apart from the subject of the ice menace. Too great caution cannot be exercised before attempting to harness natural forces of such magnitude as exist in the flow of the St. Lawrence River. Too radical a disturbance of the balance which Nature seeks to maintain may cause disaster, hence it is well to emphasize this phase of the problem, for it involves the weighing of basic physical factors of paramount importance.

Respecting character of consumption of power.—Where very large developments of power take place it is, as you know, usually necessary to have some industries, such as the electro-chemicals, take large blocks of power. These industries require cheap power. As the demand for power increases for municipal and small manufacturing purposes the experience has been that the demands for power for such uses become so urgent, and the inducements by way of price so attractive to the vendors of such power, that large industries which were attracted by the cheap power have been compelled to go farther afield. A block of power—over 65,000 h.p.—such as is exported from the Cedars plant in Quebec to the Aluminum Works at Massena, N.Y., would be sufficient, speaking on a broad basis, to supply light and power to some 35 manufacturing cities of 10,000 inhabitants each. It will be apparent from a comparison of the benefits resulting from power thus widely distributed and the localized benefits from the same power utilized in bulk, as in electro-chemical industries, that the former contributes in a much greater degree to the upbuilding of communities and

to the growth of the country at large. This feature should not be lost sight of.

Respecting the Exportation of Electrical Energy.—There is strong opposition, especially throughout Ontario, to any policy which permits the exportation of electric energy really required for use in Canada. The Federal Government has been memorialized upon this subject. It has been urged that no large power projects such, for example, as those on the international portion of the St. Lawrence River, should be developed without reserving Canada's share of the power for use here; and, further, that powers situated wholly in Canada should be reserved against the day of Canada's need. This statement is made having in mind the fact that it is not the policy of Canada to embargo her exports, but that commodities of national importance should not be exported without an adequate **quid pro quo.**

On the St. Lawrence River below Lake Ontario the first site where development involving the whole flow of the river could be made is in the vicinity of Morrisburg. With a dam near the foot of Ogden Island, a head of about 11 feet could be obtained, or, by taking in a portion of the Galop rapid, it has been thought possible to obtain a total effective head of about 15 feet. It is at this Morrisburg site—the Rapide Plat—that the New York and Ontario Power Company develops power in a small plant at Waddington, N.Y., under rights extending back for one hundred years. This company desires to reconstruct this plant and increase the development, thereby providing power for disposal in the United States as well as in Eastern Ontario. The company offers to have this project made conformable to any scheme for the development of the river as a whole.

The next possible development is that at the Long Sault Rapids, where the possible head is variously estimated to be about 35 to 40 feet. This is the site near Cornwall, where the Long Sault Development Company, a subsidiary of the Aluminum Company of America, intended to erect its dams had not their charter rights been cancelled by the State of New York—a cancellation which was confirmed by the Supreme Court of the United States.

Descending the river, we have next, in a stretch of about 14 miles between Lakes St. Francis and St. Louis, three series of rapids: the Coteau, the Cedars, the Split Rock and Cascades. The Coteau site is the one for which the Power Development Company, Limited, has been seeking rights. Of this company the "Montreal Star" states:

"There was incorporated, by letters patent a modest company, with a capital of $500,000, the incorporators being the bookkeepers of a well-known law firm in Montreal, closely associated with certain existing companies. . . . . A modest notice appeared in an obscure newspaper with a small circulation . . . . . and there was quietly filed a declaration in the Registry Offices of the counties where the proposed development is to be made, indicating that no less a scheme is on foot than the building of a dam across the St. Lawrence River."

Reliable assurances, however, have been given that rights for this development cannot be obtained without full public notice and discussion when all interested parties will have the opportunity of being heard.

The Cedars Rapids Manufacturing and Power Company utilize at Cedars rapid a head of about 32 feet developed by means of a diversion canal some two miles long. The power house has been designed for an ultimate development of 180,000 h.p. This company exports some 65,000 h.p. to Massena, N.Y.

The Soulanges plant of the Civic Investment and Industrial Company is situated a short distance below the Cedars plant. Power is obtained by tapping the Soulanges canal. The head is 50 feet.

The St. Timothee plant of the Canadian Light & Power Company is on the south side of the St. Lawrence directly opposite the two last mentioned developments. The water is led through a portion of the old Beauharnois canal.

I shall omit description of some other smaller plants, such as those at Mille Roche and in the vicinity of Morrisburg.

To summarize, we may place the estimated low-water power of the international portion of the River St. Lawrence at about 800,000 h.p., of which Canada is entitled to one half, or 400,000 h.p. The potential low-water power on the portion of the river which lies wholly within Canada would be 1,400,000 h.p. This, with its share of power along the International Boundary, makes an estimated total for Canada of 1,800,000 low-water continuous horse-power. It is detailed in the following table.

Water-Power on the St. Lawrence River*

(Tentative schedule)

Site	Head available	Estimated low-water 24-hr. h.p.	Average estimated 24-hr. low-water h.p.
Morrisburg-Rapide Plat	11-15	170,000-230,000	200,000
Long Sault rapid	30-40	500,000-650,000	575,000
Coteau rapid	15-17	230,000-260,000	250,000
Cedars rapid†	30-32	490,000-525,000	500,000
Split Rock and Cascades rapids	14-18	220,000-280,000	250,000
Lachine Rapid	20-30	300,000-450,000	375,000
Total		1,910,000-2,395,000	2,150,000

*In this table, to have the estimates fairly representative of the possible quantities which might be expected under representative low-water flow conditions, some allowances have been made for efficiency and other factors.

†Under development for about one-third of the low-water flow of the river. Consideration would be given to the possibility of combining the Coteau, Cedars, Split Rock and Cascades; also of increasing the Lachine power.

The above estimate, excluding ice conditions, is conservative. Under a "diversity load factor," such as is experienced by the Hydro-electric Power Commission of Ontario, Canada's 1,800,000 h.p. would take care of a power demand of some 2,400,000 h.p.

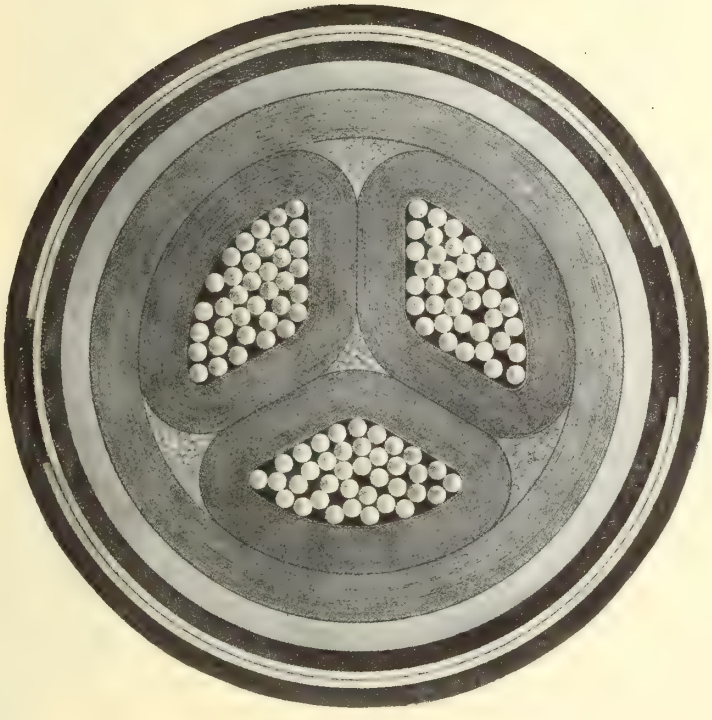
Canada's share of this power belongs respectively to the provinces of Ontario and Quebec. The Federal Government has the rights in and jurisdiction over navigation. When the time comes for international questions in connection with the development of this river to be adjusted to admit of proper development, there is no doubt that the various interests involved, whether federal, provincial, corporate or private, will, respectively, be fully taken care of. Perhaps, for example, some arrangement may be made by which the Federal Governments shall provide the dams for navigation purposes, making available for each province its share of water-power under an arrangement by which the provinces would assume such financial and other responsibilities as were purely incident to the power assets.

I trust I have adequately emphasized the absolute necessity for statesmanlike dealing with our resources of boundary waters, the wise conservation, utilization and administration of which will help build up Canada and pay our future taxes.

Monthly Meeting of Illuminating Engineers

The executive committee recently appointed by Toronto illuminating engineers have secured the promise of Lieut. Oliver, of New York City, to address them on Tuesday evening, December 3. His subject will be "Artificial Daylight." Lieut. Oliver will outline the results of a series of recent experiments which, it is understood, go a long way toward the solution of the problem of producing a good northern daylight twenty-four hours of the day. The meeting will be held in the MacLean Building at 347 Adelaide Street West. All those interested in better lighting are requested and urged to be in attendance. The meeting is called for 8 o'clock sharp.

POWER CABLE



350,000 C.M. 3-Conductor 12000 volt
Paper Insulated, Steel Tape Armoured Cable

Overall Diameter—3.62 ins.

Built to Specifications of Hydro-Electric Power Commission of Ontario

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Eugene F. Phillips Electrical Works, Limited
MONTREAL

Branches: Toronto, Winnipeg, Regina, Calgary, Vancouver

Now Then—What About Christmas?

IT is a pretty safe bet that nearly everybody is trying to spend his money these days as economically and efficiently as possible. None of us are exactly going out of our way to get rid of the coin and not a few of us are denying ourselves all pleasures and some necessities.

And now, right along comes Christmas. What are we going to do about it? Shall we make presents as usual? If so, what kind?

In our economies of living, some voluntary and others by Government regulation, we have found that lots of things we thought necessary to our existence are very easily dispensed with. Also that there is more satisfaction in spending our money on sensible articles than on flub-dubs and French pastry.

Most certainly we're going to give Christmas presents this year—one might just as well try to empty the ocean as to subdue the Christmas spirit of giving. But our Christmas presents this year, perhaps more than last year, are going to be in keeping with our established mode of living. They are going to be practical, useful gifts that will arouse in the recipient more than a mere passing sense of interest. The jim-cracks and the nick-nacks are going to be more than ever out of style.

It follows, "as the night the day," that nothing could be more consistent or worthy during our present economical and systematic living than electrical appliances. They are 100 per cent. useful, sufficiently ornamental to be pleasing and give lasting satisfaction. Moreover, electrical gifts can be chosen suitable for all ages from the little tot to the elderly totterers.

Further, the retailer who holds off until the last moment with his Christmas campaign this year and tries to send it off with a bang during the last week, is very likely to find himself among the "also-rans."

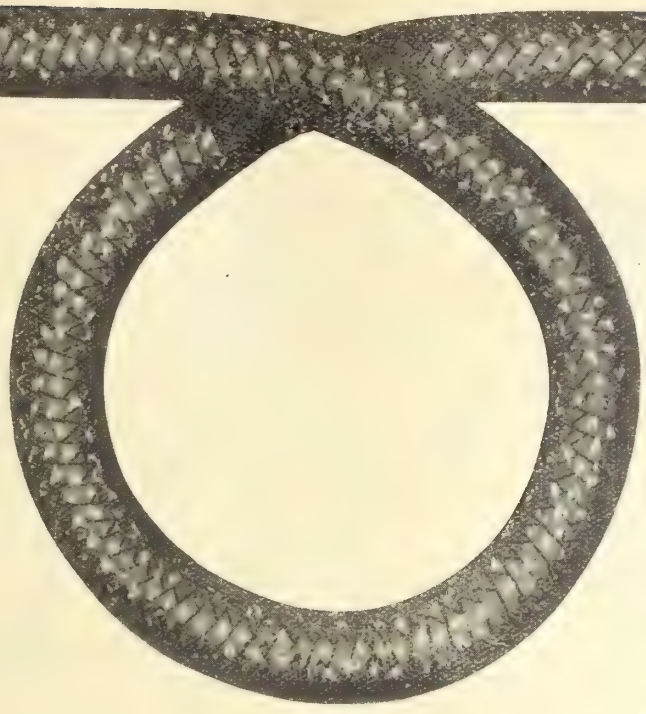
The spirit of early buying is abroad, and the electric retailer must take advantage of it. Don't lose another minute; make your slogan —"Buy early to relieve congestion; buy electrics to relieve worry and fatigue."

Electrical dealers, get your campaign under way. People are going to buy at least as usual. No one can give better value or satisfaction than you.



Sell Electrical Gifts for Christmas

The illustration above suggests big possibilities in the way of Christmas advertising.



Kraft Cord "Braiduct"

Made in Canada under Canadian Patent No. 147,057

This cut is reproduced from an actual photograph, and illustrates the behavior of the material in this rigid test—perfect flexibility. We cut the ends to show plainly the superior construction—note the high grade Canvas Duck Lining and the KRAFT CORD winding. This KRAFT CORD is made to our own specifications and is fire-proofed, which is entirely new.

KRAFT CORD "BRAIDUCT" is in a class by itself—superior to any imported conduit—is absolutely the last word in flexible non-metallic conduit construction.

We are now making our own insulating compounds, consequently every lot will be uniform in flexibility, and every foot is fished at the factory.

KRAFT CORD "BRAIDUCT" is easy to instal—easy to cut—easy to secure, as it is made in our own country, and easy to buy, as our price is right.

KRAFT CORD "BRAIDUCT" is packed in heavy fibre boxes, each box containing four coils (1,000 ft.), insuring product against damage in transit.

KRAFT CORD "BRAIDUCT" is regularly inspected and labelled by the **Underwriters' Laboratory** under the direction of the **National Board of Fire Underwriters** and every coil carries their label.

We will be glad to send you a sample.

The Flexible Conduit Co.

Limited

Guelph - Canada

Daum Refillable Plug Type Fuse

The illustration herewith shows a new refillable plug fuse manufactured by A. F. Daum. This is made of porcelain, the only metal being the fuse strip which is readily inserted afresh when a fuse is blown. The company state that the Oriental Electric Industrial Corporation, of Hagoga, Japan,



have just completed negotiations for a sole license in Japan, under the Daum patents. Mr. S. Mori, chief engineer for the Corporation, was recently at the Daum plant getting details, and stated that hitherto all fuses have been imported, and that the company he represents will be the first to make renewable fuses in the far East.

Victoria Electric Supply Co. Change of Address

The Victoria Electric Supply Company, jobbers of electrical supplies and fixture parts, announce that they are removing their business from 157 King Street, West, Toronto, to the ground and first floors of the Nordheimer Building, 77 York Street, just south of King. The new premises are very commodious and will admit of the more expeditious shipment of goods and also will enable the company to carry a more extensive stock of supplies. It is their intention to add to their lines a varied assortment of glassware and a complete line of automobile accessories.

Personals

Mr. Stanley Ebbett, of the New Brunswick Telephone Company at Moncton, has been appointed superintendent of traffic with headquarters at St. John.

Mr. F. T. Atkinson, district superintendent for the New Brunswick Telephone Company at Fredericton, N.B., has been transferred to Moncton, succeeding Mr. Stanley Ebbett.

Mr. Frank Harris, formerly exchange manager for the N. B. Telephone Company at Sackville, N.B., has been appointed district superintendent with headquarters at Fredericton.

Mr. C. F. Sise, general manager of the Bell Telephone Company, has been elected vice-president of the company, in succession to the late Mr. C. Cassils. He has been connected with the telephone business during his entire commercial life. After graduating as B.Sc. from McGill, he took up the study of telephone engineering; was later made superintendent of toll lines of the Bell Telephone Company, and in 1903 was appointed assistant superintendent of the company. Three years later he was made general superintendent, and in 1911 general manager. His present title is vice-president and general manager.

Messrs. F. H. Phippen and H. W. Harper have been appointed arbitrators in the matter of the demands of employees of the Toronto Street Railway Company. Mr. Phippen will represent the company and Mr. Harper the men.

Current News and Notes

Fredericton, N.B.

The New Brunswick Telephone Company have completed a long distance line between Fredericton and Minto.

Grand Forks, B.C.

A tram line will be built at the Rock Candy Mine, Lynch Creek, to connect with an extension of the Kettle Valley line a couple of miles above Lynch Creek. The new line will be a mile and a half in length.

London, Ont.

The city of London, Ont., recently applied to the Dominion Railway Board for permission to charge the Bell Telephone Company a rental of 25 cents for each pole or foot of underground conduit used in that city. The Railway Board stated that the matter would require parliamentary legislation and as the Bell Telephone Company would likely oppose the measure very strenuously, it is not likely that London will carry the subject further.

Montreal, Que.

The Shawinigan Water & Power Company have under consideration the development of Gres Falls, on the St. Maurice River. This water power was purchased from the Union Bag & Paper Company, of New York.

With a capital of $20,000, La Minoterie Moderne, Ltd., has been formed to take over the business of Laurin and Frere, Charlemagne, P.Q., and to develop water powers in the counties of L'Assomption, Montcalm, and Joliette.

The Dominion Bridge Company, Limited, Montreal, has received an order for two 5 motor, 40 ton capacity, 60 foot span electric travelling cranes from the British America Nickel Corporation, Limited, at Sudbury, Ont.

Ste. Anne de Bellevue, Que.

The Public Works Department, Ottawa, have awarded the contract for the construction of a light and power transmission line at St. Anne de Bellevue, P.Q., to the Artistic Brass Works Company, 250 Beaver Hall Hill, Montreal. The line is in connection with a group of military hospital buildings recently erected. The price is $5,500.

St. Thomas, Ont.

It has been definitely decided that the track and equipment of the London and Lake Erie Transportation Company will be scrapped. The city of St. Thomas will be paid $3,700 in settlement of back rental for the use of the city's tracks and will allow the company to continue using the tracks for hauling material until they cease operating.

Sherbrooke, Que.

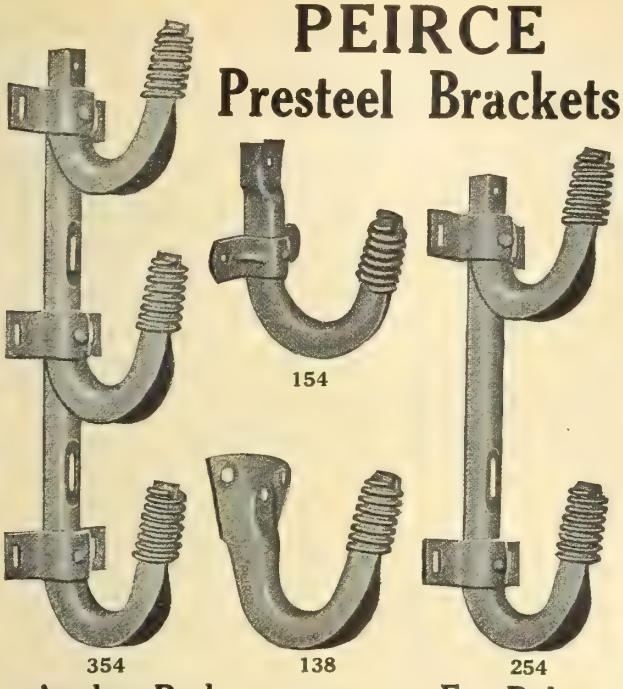
The city of Sherbrooke, Que., has put into operation a new transmission line from Weedon to Sherbrooke, thus adding about 1,000 h.p. to the current available for manufacturers. The city purchased the property of the Two Miles Falls Power Company, installed new transformers and built the transmission line now in operation. A second unit is being installed at Weedon.

Toronto, Ont.

In accordance with an order by the Ontario Railway Board the Toronto Street Railway Company have taken on about 300 new men and have added about 175 more cars to the service. The Railway Board has ordered the company to place in service every available car.

Electrical workers in Toronto and vicinity, who are said to be now 90 per cent. organized against 40 per cent. seven months ago, are at present negotiating with employers for a new wage schedule, The union and employers, it is understood, are completely harmonious.

PEIRCE
Presteel Brackets



Anchor Rods **Eye Bolts**
Cross Arm Braces
Turn Buckles **Machine Bolts**
all Hot Galvanized

Acme Stamping & Tool Works Ltd.
Hamilton, Ont.

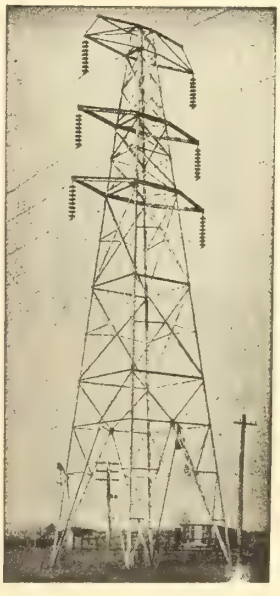
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"The material of a thousand uses"

THE ANHYDROUS PHENOL RESIN COMPOUNDS

They excel in
Heat Resistance—Dielectric Strength—Mechanical Strength—Accuracy of Dimensions
furnished in
sheets, tubes, rods, granular, molding plastic, impregnating liquids.
Write us for our catalog.

Redmanol Chemical Products Co.
676 West 22nd Street, CHICAGO

GALVANIZED STEEL
TOWERS AND POLES



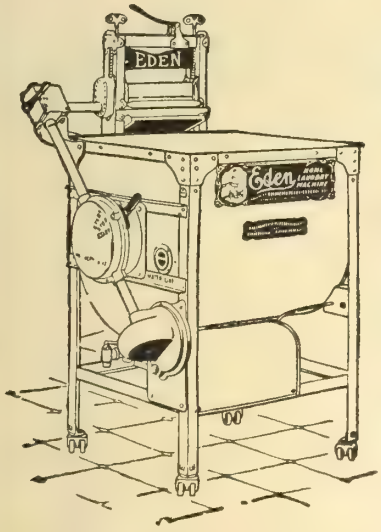
Standard Tower of the Hydro Electric Power Commission of Ontario

The modern means of supporting overhead wires.

Power
Telephone
and
Trolley
Lines

We shall be pleased to furnish designs and estimates upon request.

The Canadian Bridge Co., Limited
Walkerville, Ontario, Canada
Structural Steel of all Kinds
Montreal Office in New Birks Building.



The EDEN Electric Washer

Good Profits—Easy Sales

are assured for the dealer who handles the Eden Washing Machine. A first grade machine, that once sold, stays sold and brings new customers.

Write for our proposition

Great West Electric Co., Limited
WINNIPEG
Distributors of Laco Tungsten and Nitro Lamps

Mica Insulation

We manufacture everything, including:—
Tubes, Motor Rings Washers,
Built Up Plate
Flexible-Mica Cloth and Paper

Raw Mica (cut or uncut) **Ground Mica**

Mica Company of Canada, Ltd.
P. O. Box 156, HULL, Quebec

Motor For Sale

We have [illegible] for immediate delivery one [illegible] H.P., 3 phase, 60 cycle, 550 or 2200 volts, 600 R.P.M. Westinghouse form M [illegible] type, squirrel cage induction motor, [illegible] starting coil and oil switch. This motor is designed for direct connection, [illegible] equipped with special wooden pulleys [illegible]. The motor has been entirely re[illegible] and is as good as new. For further particulars write or wire Railway & Power Engineering Corporation, 203 C. P. R. Bldg., Toronto, Room 10, Windsor Hotel, Montreal. 23

Electrical Contractors Appliance Manufacturers

A [illegible] would join now or established business of 17 years electrical experience. Installation, [illegible] sales and factory management. Would purchase interest in good proposition.

W. HERBERT TEES,
23 Box 326, Ingersoll, Ont.

How Pennies in the Mail Sold Irons

You've got to hand it to the ladies! The following letter was received by the Westinghouse Company from Miss J. A. Kerkhof, Manager of the Seymour, Indiana, Store, of the Interstate Public Service Company:

"We are in receipt of some little booklets and folders from you which we consider the most attractive and valuable advertising helps. Please find enclosed sample letter which we are sending out to a number of iron prospects with which we are using your booklets."

With this letter came a small envelope, just the proper size for enclosing folder, "Labor Savers for the Home," for that is the little booklet referred to by Miss Kerkhof. And in each envelope with the folder was a brand new penny. Accompanying this envelope with its folder and penny was a letter that drove the penny right through the folder and into baby's bank, but not without bringing the desired results:

"A bad penny always returns," says the letter, "but this is not a bad penny, and we don't want it returned. Keep it for luck, or put it in the baby's bank." That's the introduction to the penny and then the letter states that the penny was sent for two reasons, one to pay for reading the letter and the second to bring to the reader's attention the tremendous power back of the penny. How two of these little pennies each day would pay for an ironing and how simple it was to secure the iron by phoning Miss Kerkhof.

And when the call came over the phone she got there in a hurry. That is one of the ways she has placed 725 irons in the homes of 890 residence consumers. Of course, Miss Kerkhof knew what the ladies in Seymour were missing by not ironing electrically and she didn't add much to their pleasure until she had them persuaded.

But we just have to hand it to the ladies these war times, and we take our hats off to Miss Kerkhof with 725 irons out of 890 possibilities.—In "Contact."

PETRIE'S LIST
of New and Used MOTORS
FOR IMMEDIATE DELIVERY

No.	H.P.	Phase	Cycle	Volts	Speed	Maker
1	100	3	25	550	480	Westg.
2	50	3	25	550	725	Westg.
1	30	2	60	220	1500	T. & H.
1	30	2	60	220	720	Fbks.-M.
1	25	2	60	220	945	Westg.
1	20	3	25	550	1440	J. & M.
1	20	3	25	550	710	Westg.
2	15	3	25	550	1400	Lancashire
3	15	3	25	550	730	Westg.
1	10	3	25	550	720	Westg.
1	7½	3	25	550	1500	Lang-Dav.
2	7½	3	25	550	725	Westg.
1	7½	3	25	550	750	C. G. E.
1	6	2	66	220	1200	T. & H.
3	5	3	25	550	1440	Excelsior
2	5	3	25	550	1400	Excelsior
3	5	3	25	550	720	Westg.
5	4	3	25	550	1400	Excelsior
2	3	3	25	550	1500	C. G. E.
2	3	3	25	550	1400	Excelsior
1	1	3	25	550	1400	Excelsior
1	¼	1	60	110	3400	Diehl

Write Us for Prices

H. W. PETRIE, Limited
Front St. West - Toronto, Ont.



Rubber Covered Wires and Cables
FOR POWER, LIGHT AND TELEPHONE WORK
Incandescent Lamp Cord, Flexible Switchboard Cables, Special Cords and Cables for all kinds of Electrical Work.

Prompt Shipments from Canadian Factory.

BOSTON INSULATED WIRE & CABLE CO., Limited
Canadian Office and Factory, HAMILTON, ONT.

The FISHER ELECTRIC CO.
43 Britain Street, TORONTO
New and Used Machinery
MOTORS GENERATORS
TRANSFORMERS
WRITE US WHAT YOU WANT TO BUY OR SELL
Large Stock Carried

Northern Aluminum Co., Ltd.
1305 Traders Bank Building
TORONTO, ONT.
Manufacturers of Aluminum
Ingot, Sheet, Tubing, Wire, Rod, Rivets, Moulding, Extruded Shapes, also Electrical Conductors all Aluminum and Steel Reinforced

Litot Aluminum Solders and Flux
will solder aluminum to itself or other metals
WRITE FOR INFORMATION

NOTICE

Following New and Slightly Used Equipment will be sold Immediately at Greatly Reduced Prices.

MOTORS

25 Cycle, 550 Volt, 3 Phase

No.	H.P.		Speed
1	150	(2200 v.)	720
1	100	(2200 v.)	500
1	75		500
3	50		500
4	50		720
1	40		720
1	30		720
2	25		720
1	20		720
3	15		720
1	10		720

TRANSFORMERS

25 (or 60) Cycles, S.P.

No.	K.V.A.	Volts
3	100	13200-6600/2200
3	150	13200-2200
5	300	2200-550
3	50	2200-550
3	40	2200-550
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1	5	1870	Sh.			Gen. E.
1	10	850	Sh.		MP	Gibbs
2	10	750	Sh.			North'n.
1	15	725	Cp.		MP	Nor'wst
2	17½	585	Sh.		A-14	Gibbs
1	20	900	Sh.		MP	Hobart
1	20	975	Sh.		CS	West.
1	20	675	1006		E	Fb.Mrs
1	20	750	Sh.			North'n.
1	20	800	Sh.			Imy.
1	20	650	Sh.			Milw
1	20	600	Sh.			West. E
1	25	575	Sh.		MP	North'n.
1	25	650	Sh.		WS-25	Ntl. Bl.
1	30	525	Sh.		MP	North'n
1	30	250/280	Cp.	Interpole		G. E.
1	40	675	Sh.			Nor'wst
1	40	550	Sh.		M	West.
1	50	525	Sh.		MP	Nor'wst
1	50	625	Sh.		A 40	Milw.
1	55	575	Sh.		6½AOR	West E
1	75	850	Sh.		MP	Milw.
1	120	450	Cp.		MPA	Gen. E
1	150	650	Sh.		MP	Imry

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No.	HP	RPM	Vts.	Type	Make
12	20	1200	440	AN	Allis Chal.
6	20	900	220	AN	Allis Chal.
8	20	900	440	AN	Allis Chal.
5	20	720	220	AN	Allis Chal.
4	20	720	440	AN	Allis Chal.
1	20	900	440	KT	Gen. Elec.
1	25	900	440	KT	Gen. Elec.

No.	HP	RPM	Vts.	Type	Make
10	25	1800	220	AN	Allis Chal.
8	25	1800	440	AN	Allis Chal.
3	25	1200	220	AN	Allis Chal.
3	25	1200	440	AN	Allis Chal.
1	25	900	220	AN	Allis Chal.
1	25	900	440	AN	Allis Chal.
6	25	720	220	AN	Allis Chal.
4	25	720	440	AN	Allis Chal.
7	30	1800	220	AN	Allis Chal.
5	30	1800	440	AN	Allis Chal.
5	30	1200	220	AN	Allis Chal.
5	30	1200	440	AN	Allis Chal.
4	30	900	220	AN	Allis Chal.
4	30	900	440	AN	Allis Chal.
4	30	720	220	AN	Allis Chal.
3	30	720	440	AN	Allis Chal.
2	40	1800	220	AN	Allis Chal.
2	40	1800	440	AN	Allis Chal.
5	40	1200	220	AN	Allis Chal.
4	40	1200	440	AN	Allis Chal.
6	40	900	220	AN	Allis Chal.
6	40	900	440	AN	Allis Chal.
2	50	1200	220	AN	Allis Chal.
2	50	1200	440	AN	Allis Chal.
8	50	900	220	AN	Allis Chal.
8	50	900	440	AN	Allis Chal.
3	50	720	220	AN	Allis Chal.
2	50	720	440	AN	Allis Chal.
1	65	1200	550		Gen. Elec.
3	75	900	220	AN	Allis Chal.
3	75	900	440	AN	Allis Chal.
1	75	720	220	AN	Allis Chal.
4	100	900	220	AN	Allis Chal.
4	100	900	440	AN	Allis Chal.
1	100	720	440	AN	Allis Chal.
1	150	490	440	MS	Westclise
1	100	720	2200	AN	Allis Chal.
1	100	900	2200	AN	Allis Chal.
1	150	900	2200	AN	Allis Chal
1	150	720	2200	AN	Allis Chal.
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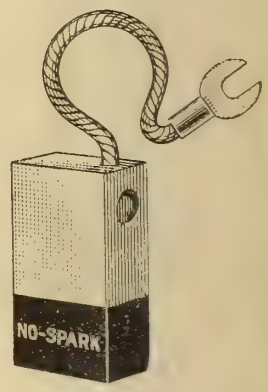
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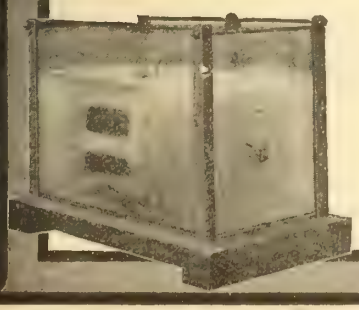
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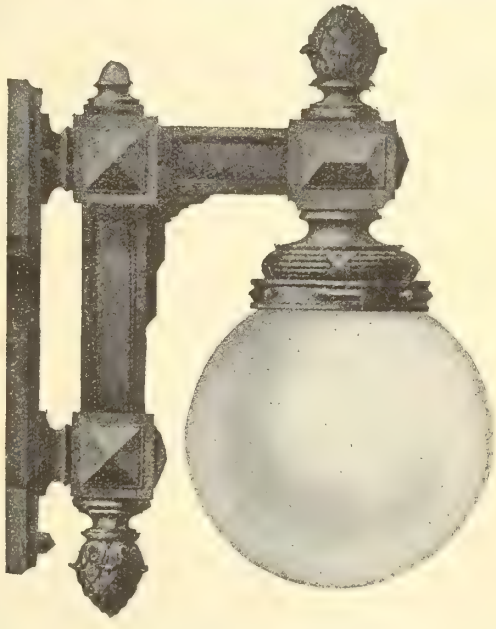
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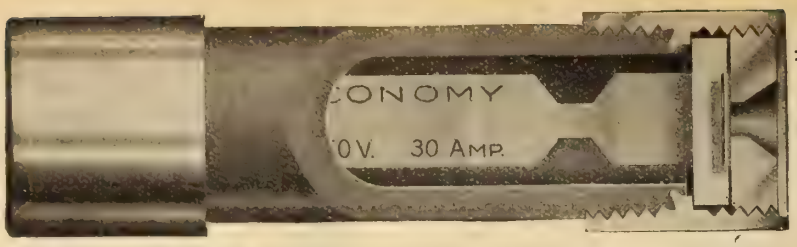
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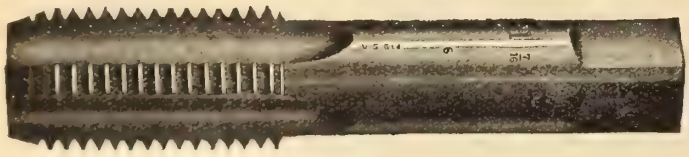
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30	H. P.	550	V.	900	R. P. M.	2
40	H. P.	550	V.	1200	R. P. M.	1
50	H. P.	550	V.	900	R. P. M.	2
75	H. P.	2200	V.	850	R. P. M.	1
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1	60	3	750	550	25	yes	Crocker Wheeler
2	50	3	750	220	25	yes	Lincoln
1	25	3	750	220	25	yes	Lincoln
1	25	3	750	220	25	yes	C.G.E.
1	10	3	1500	220	25	yes	T.H.E.
1	3	3	1500	220	25	yes	Westg. CCL.
1	½	1	1800	110	60	no	Fort Wayne
1	¼	1	1800	110	60	no	Westgh.
1	¼	1	1800	110	60	no	Fisher
1	40	2	900	220	60	yes	Fuller Wenstrom
1	15	2	1800	220	60	no	T.H.E.
2	5	2 or 3	1800		60	no	Westgh. CCL. rewd.
2	1	2 or 3	1800		60	no	Westgh. CCL. rewd.
1	½	2	1800	220	60	no	Westgh. CCL.
2	10	2 or 3	1200		60	no	Westgh. CCL. rewd.
1	5		1200	220	60	no	Union (New)
2	3	3	1800	220	60	no	C.G.E. rewound
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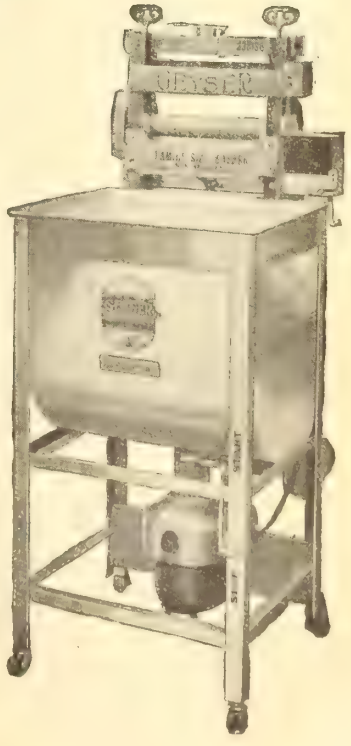
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DREDGING PUMPS
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ELECTRICAL ENGINEERS
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See Directory of Engineers.

ELECTRIC HEATERS
National Electric Heating Company

ELECTRIC SHADES
Jefferson Glass Company

ELECTRIC RANGES
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National Electric Heating Company
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ELECTRIC RAILWAY EQUIPMENT
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Canadian Allis-Chalmers Company

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Canadian Westinghouse Company
Century Electric Company
Great West Electric Company
Northern Electric Company
Pringle, R. E. T.
Robbins & Myers

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Spaulding & Sons Company, J.

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Northern Electric Company
Tallman Brass & Metal Company
Walger Connector Company

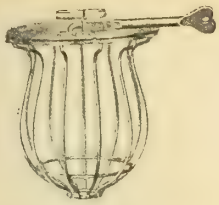
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Northern Electric Company
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Tubular Woven Fabric Company

FLOOD LIGHTS (Electric)
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Daum, A. F.
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G. & W. Electric Specialty Company
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Moloney Electric Company of Canada
Northern Electric Company
Square D Company

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No. 5685


No. 5735


No. 6915


No. 5406


No. 5573


No. 3618

HUBBELL SPECIALTIES


No. 5950


No. 3664


No. 3421


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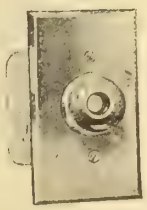

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No. 8101
No. 8103


Cap No. 5421
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Jones & Glassco

HYDRO ELECTRIC MACHINERY
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Mica Company of Canada

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Great West Electric Company
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Lincoln Electric Company
MacGovern & Company
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Pringle, R. E. T.
Robbins & Myers
Thomson Company, Limited, Fred
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Spielmann Agencies Regd.

PAINTS & COMPOUNDS
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McGill Manufacturing Company
Spielmann Agencies, Registered.
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Boving Hydraulic & Engineering Company
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Pringle, R. E. T.

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PORCELAIN BUSHINGS
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Electrical Maintenance & Repairs Company
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Canadian Westinghouse Company

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Benjamin Electric Manufacturing Company
Duncan Electrical Company
Monarch Electric Company
National Metal Molding Company
Northern Electric Company
Pringle, R. E. T.

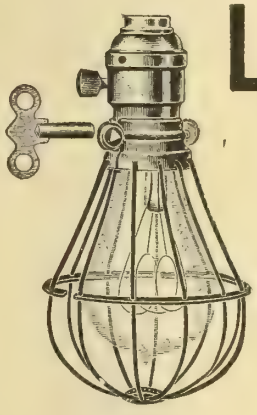
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Harvey Hubbell Company

SOCKETS
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Crouse-Hinds Company of Canada, Limited.
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(Continued on Page 56)

LAMPS Locked On Can't Get Stolen

They can't get knocked out or broken.



LOXON

guards give your lamps just such protection.

Sold at a popular price. Our Loxon Lamp Guards and other Specialties demand the attention of every handler of Electrical Goods.

Let us send our list.

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"Duncan" Pull Chain Sockets

NOW READY

Snap Cap



No. 5000

Splendid Action

This Socket is Second To None

Your Jobber, or

The Duncan Electrical Company, Limited

MONTREAL - CANADA



STANDARD Wires and Cables

include a complete line of bare and insulated electrical conductors for all classes of service, also cable accessories. We also can supply copper, and brass tubes and rods, extruded brass shapes, etc. We are in a position to serve all users of these products to good advantage.

Write our nearest office.

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ELECTRICAL PORCELAIN

Solid Knobs, Split Knobs, Cleats, Tubes, and special Porcelain of all kinds.



Strain and Screw Thread Insulators. Unsurpassed in quality and design.

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will double the life of your pole lines. Our treating plant at Nakusp, B.C., uses either Creosote or Carbolineum as you prefer.

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Northern Electric Company

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Northern Electric Company

TOASTERS
Flexible Conduit Company
National Electric Heating Company
Northern Electric Company
Renfrew Electric Company
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Onward Manufacturing Company
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CANADIAN PORCELAIN CO.

LIMITED

HAMILTON - CANADA

Manufacturers of High and Low Tension Porcelain Insulators



Are You Prepared

For the

Fall Drive

If not place your orders early for

MONARCH SHRAPNEL

If your local jobber does not handle our lines write direct

"Pittsburgh" Reflectors

Increase Light 500%

BY TEST

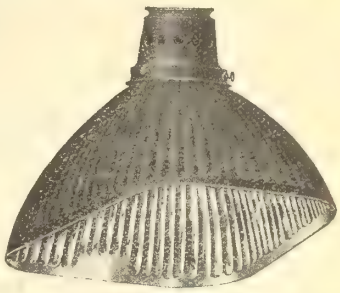


Illustration shows "Pittsburgh" Reflector No. 50 for 100 or 150 Watt Lamp. Dimensions: Height, 9½ inches, Width 10 inches. Holder 2¼ in. Form "O".

They are scientifically formed to obtain the maximum of light on the window trim. "Pittsburgh" Reflectors have attained extensive sales for window lighting, because of their saving of current and their dependability to increase lighting efficiency.

Pittsburgh Reflector and Illuminating Co.

PITTSBURGH, PA.

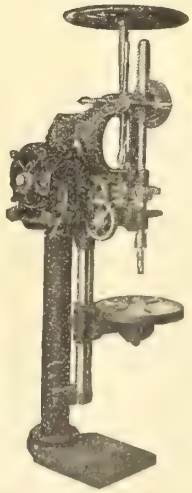
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Century

Repulsion Start Induction



½ H.P. Motor mounted on an all geared Drill Press

SINGLE PHASE MOTORS

1/10 to 40 H.P. 25 to 140 Cycles

Are built to accurate dimensions with the use of standard jigs and gauges, hence all parts are interchangeable.

They Keep-a-Running

CENTURY ELECTRIC COMPANY

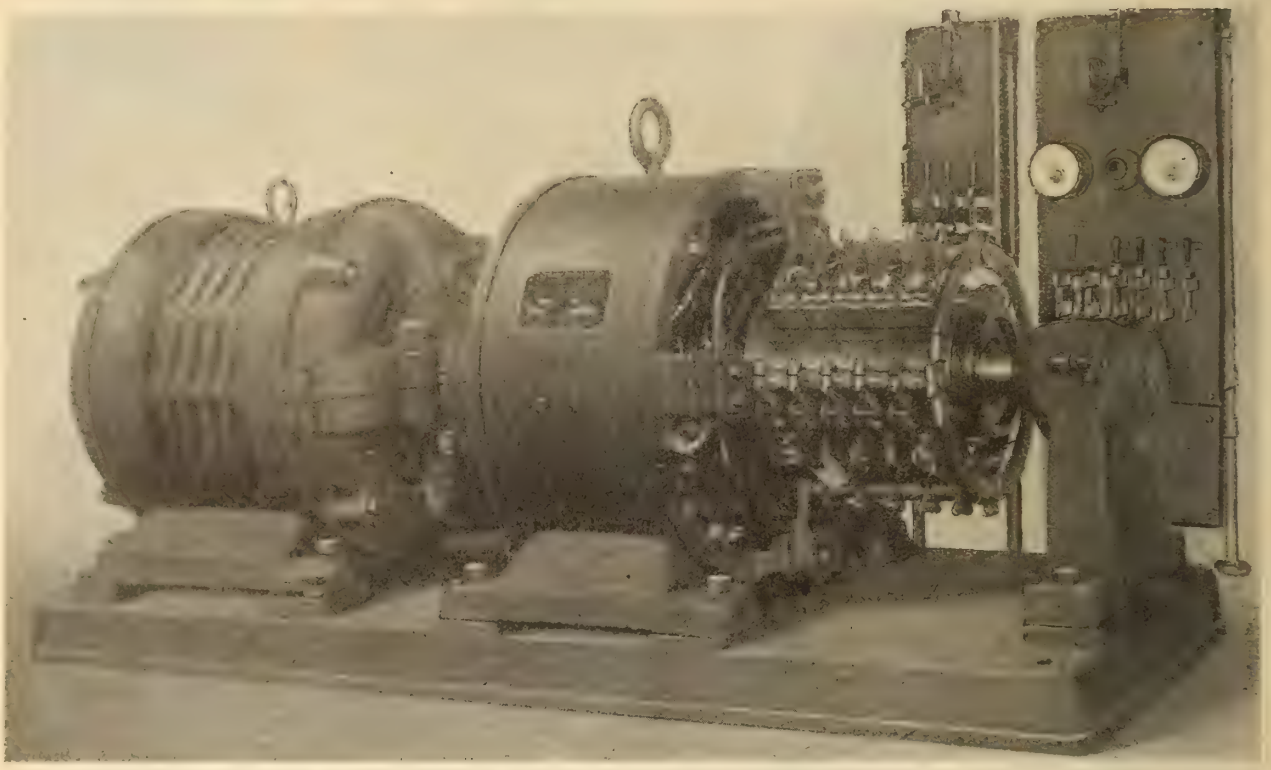
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Sales Offices in the Principal Cities 301

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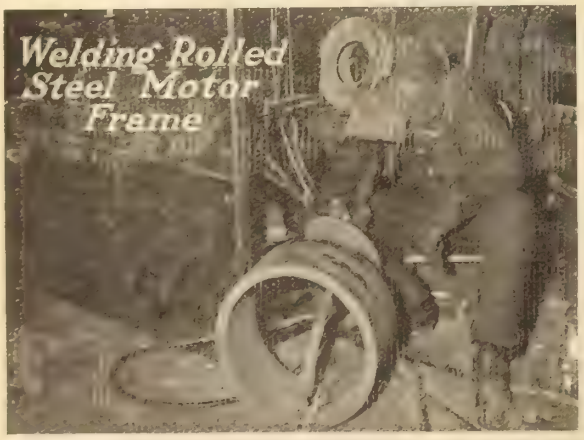
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Westinghouse Arc Welding Motor-Generator Equipment

The flexibility of Westinghouse Electric-Arc Welding Equipments allows the quick execution of a wide range of repair jobs, not possible by other methods.

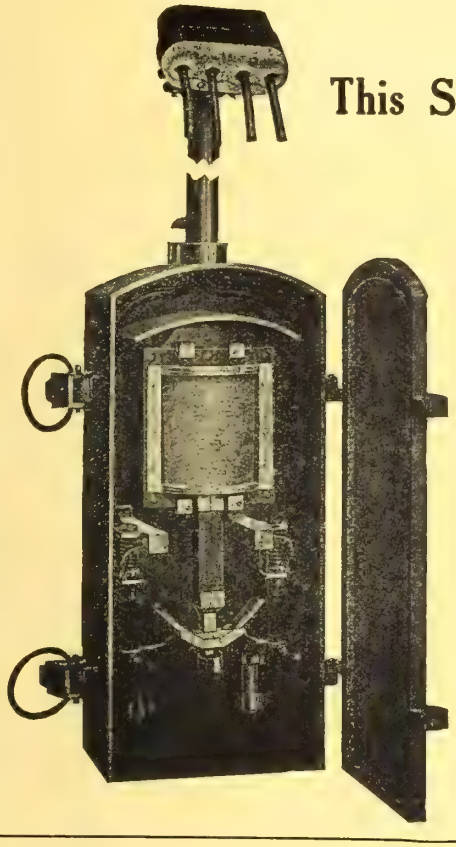


It is designed with a view to the utmost simplicity, avoiding complicated control devices, so that the ordinary mechanic can use the equipment with ease and safety.

Our Leaflet 1826 gives full details.

Canadian Westinghouse Co., Limited, Hamilton, Ontario

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This SOLENOID SWITCH has been adopted by the Hydro Electric Commission

They use it for

STREET LIGHTING

Now the fact that it is used by the Hydro-Electric Commission is proof that it is all we claim for it. It certainly is not an experiment, by the fact that it is giving efficient service in many towns throughout Ontario, as well as the other provinces.

No springs, swivels or other complicated mechanisms to give trouble. They close magnetically and are opened by gravity assisted by the tension of the laminated copper contact. All arcing is taken up on the carbons.

Increase the efficiency of your system and decrease the cost of installation by using our Type 17 H.E.P. Solenoid Switches, which are suitable for any frequency on multiple circuit or D.C. Series circuit.

Write for complete descriptive particulars

The Electrical Maintenance & Repairs Company, Limited

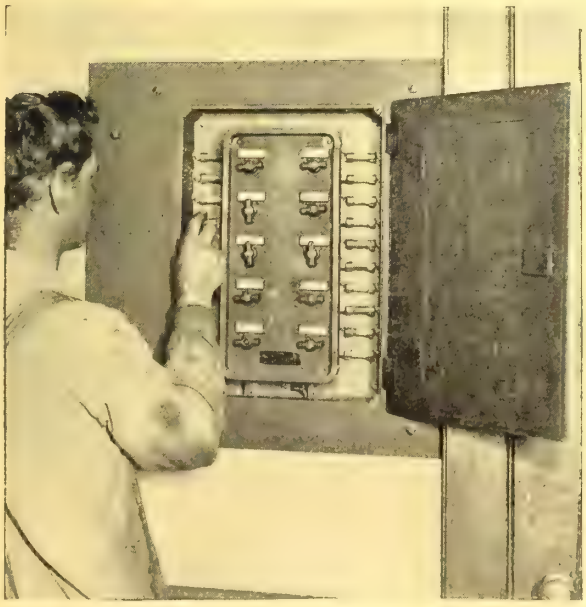
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TORONTO

Nights Beach 1723-1930

The Fuses Are Easily Renewed

but only by authorized persons on



Krantz Safety Panel Boards

The door is in two parts. The inner door gives access to the switches only, where every reachable part is dead. The lights can, therefore, be turned on and off in perfect safety.

The outer door, which covers the fuses, can be locked, so that only the electrician can open it.

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We have a large stock of

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Motors and Generators

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We extend a cordial invitation to the electrical fraternity to call upon us in our new building—the largest and best equipped electrical repair establishment in Canada.

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Reduce Distribution Troubles and Expense

in these Five ways—

—Equip to handle "trouble" without costly cable or line cutting.
—Eliminate expensive "temporary" repairs.
—Install cable-end sealing devices.
—Stop extended service delays.
—Make every circuit interconnecting without cable or line cutting.



IT is the purpose of G & W distribution specialties to obtain maximum distribution **economy** for a minimum of **cost**—it is the purpose of G & W Engineering Service, with 15 years' experience for a working back-ground, to see that you **do** get just that.

Nowadays **preventable** waste is almost the same as deliberate destruction. G & W distribution specialties plus G & W application service can help you eliminate many costly, untimely distribution troubles. Ask us for the solution of your most troublesome distribution problems!

Have you received new Catalog No. 10? Contains Valuable illustrations and drawings for every Central Station Engineer

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Distribution Engineers, Manufacturers of Potheads of all kinds.
Switching and Distribution Boxes, Overhead and Underground Distribution Specialties.

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Bentz-Richardson Co., Ltd., 592 Notre Dame Ave., Winnipeg
General Supplies, Limited, Calgary and Edmonton.

XXVII No. 24 Toronto, December 15, 1918

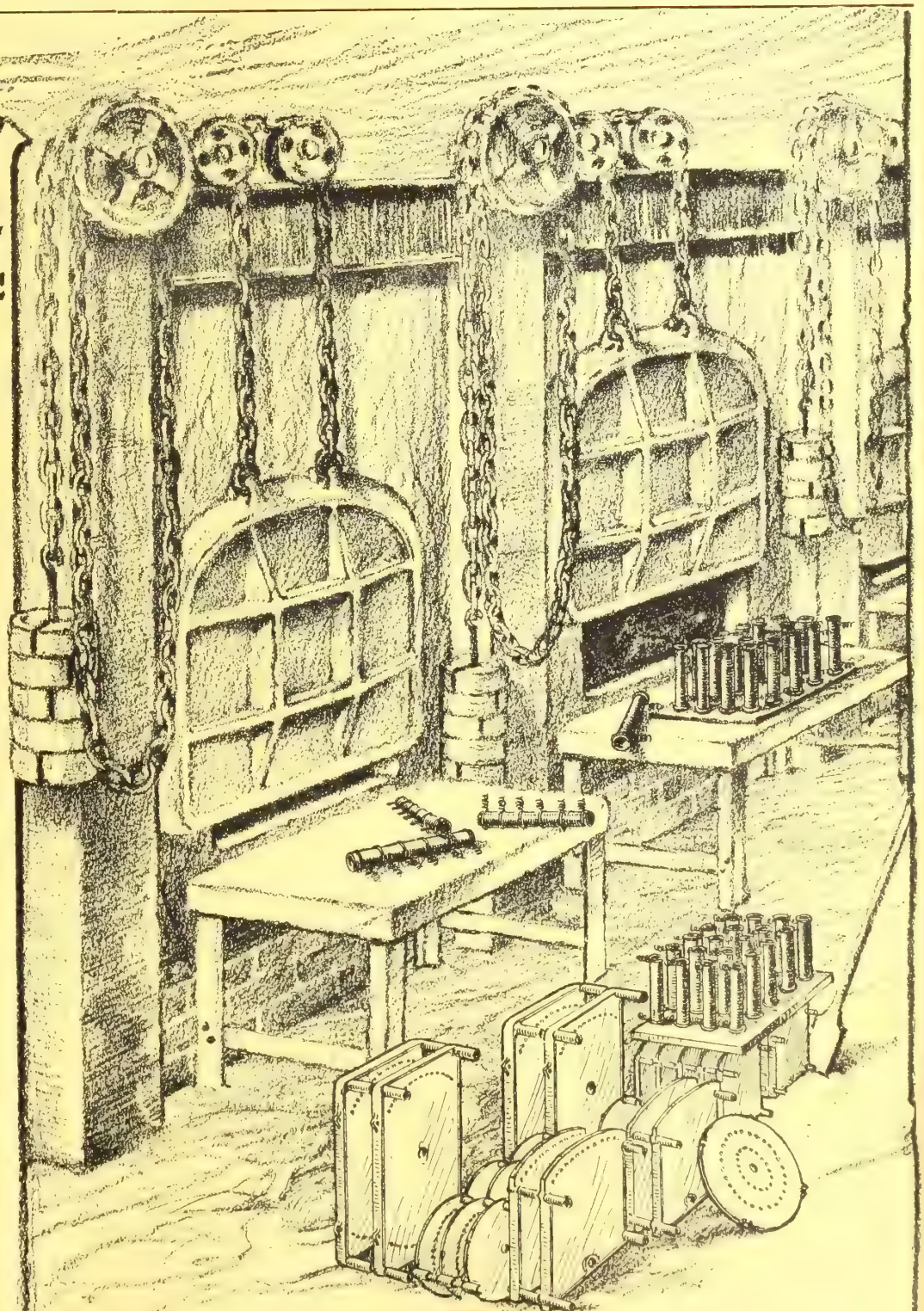
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Generation, Transmission and Application of Electricity

A Quarter-Century of Continuous Production

Since Vitreous Enamel Insulation was first developed by Ward Leonard, upwards of twenty-five years ago. our furnaces have been in continuous production without even a twenty-four-hour idle period.

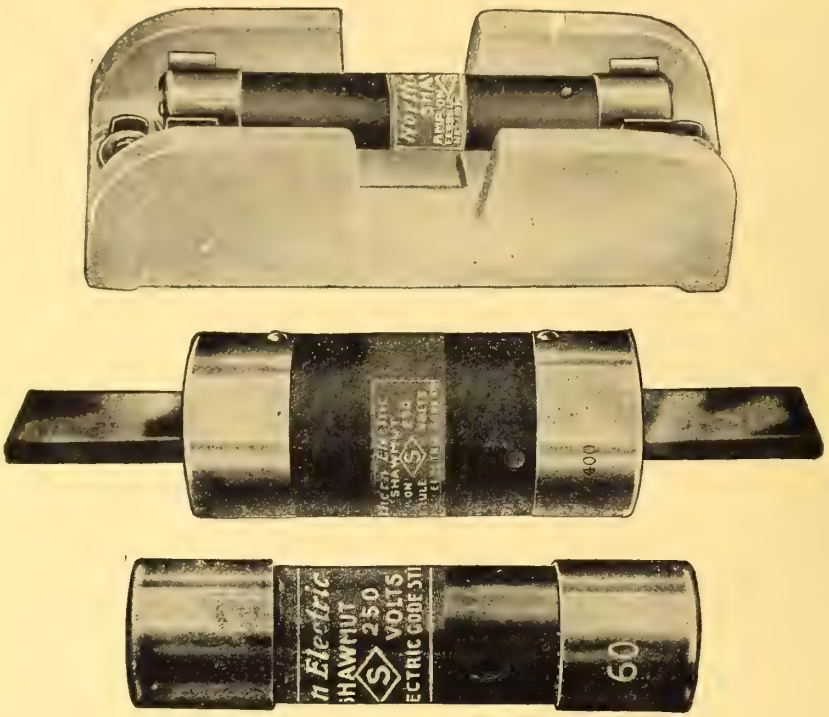
Such a record is some indication of the high calibre of Ward Leonard Resistance units, and Resistance Plates, the resistance elements of which are permanently sealed by Vitreous Enamel Insulation against any service deterioration.



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Mount Vernon, New York

Northern Electric Shawmut Fuses and Cutouts



The Fuses with:

Positive visual indicator

Ampere capacity stamped on ferrule

Copper current carrying parts

Full approval of all Underwriters' Organizations and Inspection Bureaus.

The Fuses That Give Positive Protection

Northern Electric Company

LIMITED

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OTTAWA
TORONTO
LONDON
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VANCOUVER

TRADE BUSS MARK

Buss Fuses

MAKE ELECTRICITY SAFE FOR MANKIND

Canadian Trade supplied direct from Toronto Branch.

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Fuses bearing the Buss trademark and indicated Amperage may be counted upon absolutely to give the results desired.

GUARANTY: Every Buss Fuse will hold an ***overload*** of 10 per cent. ***indefinitely,*** and ***blow*** at 50 per cent. overload in time-limit allowed by underwriters.

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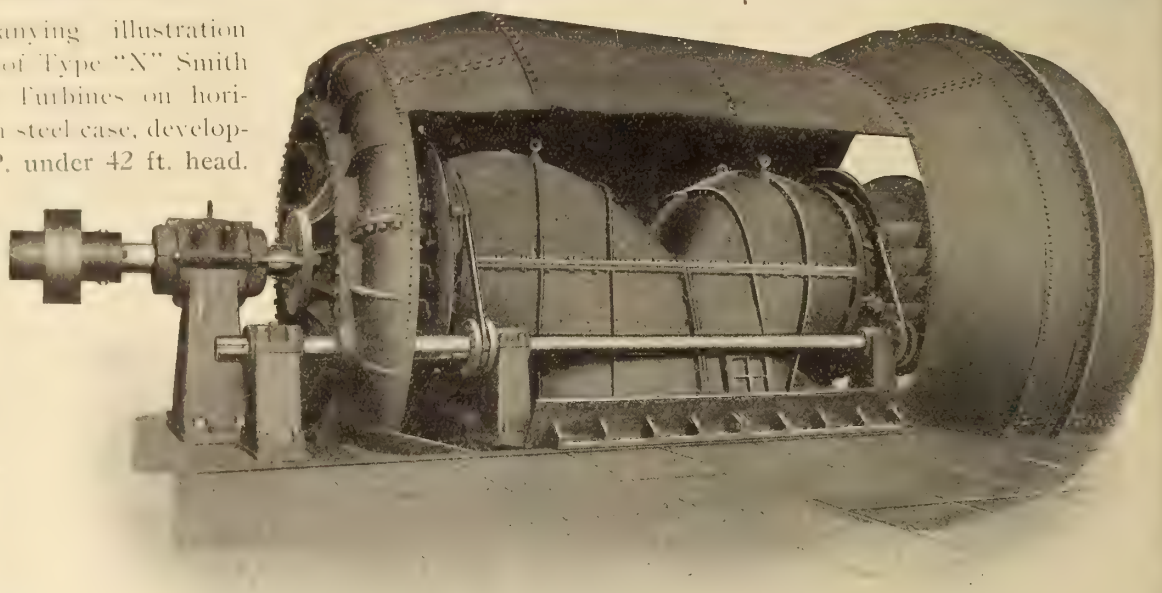
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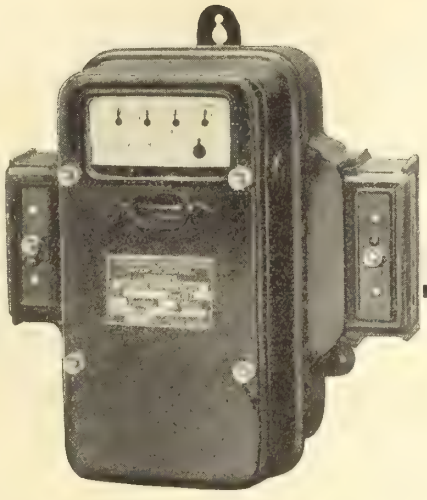
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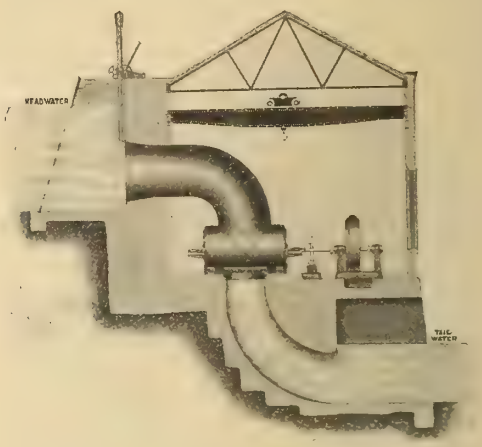
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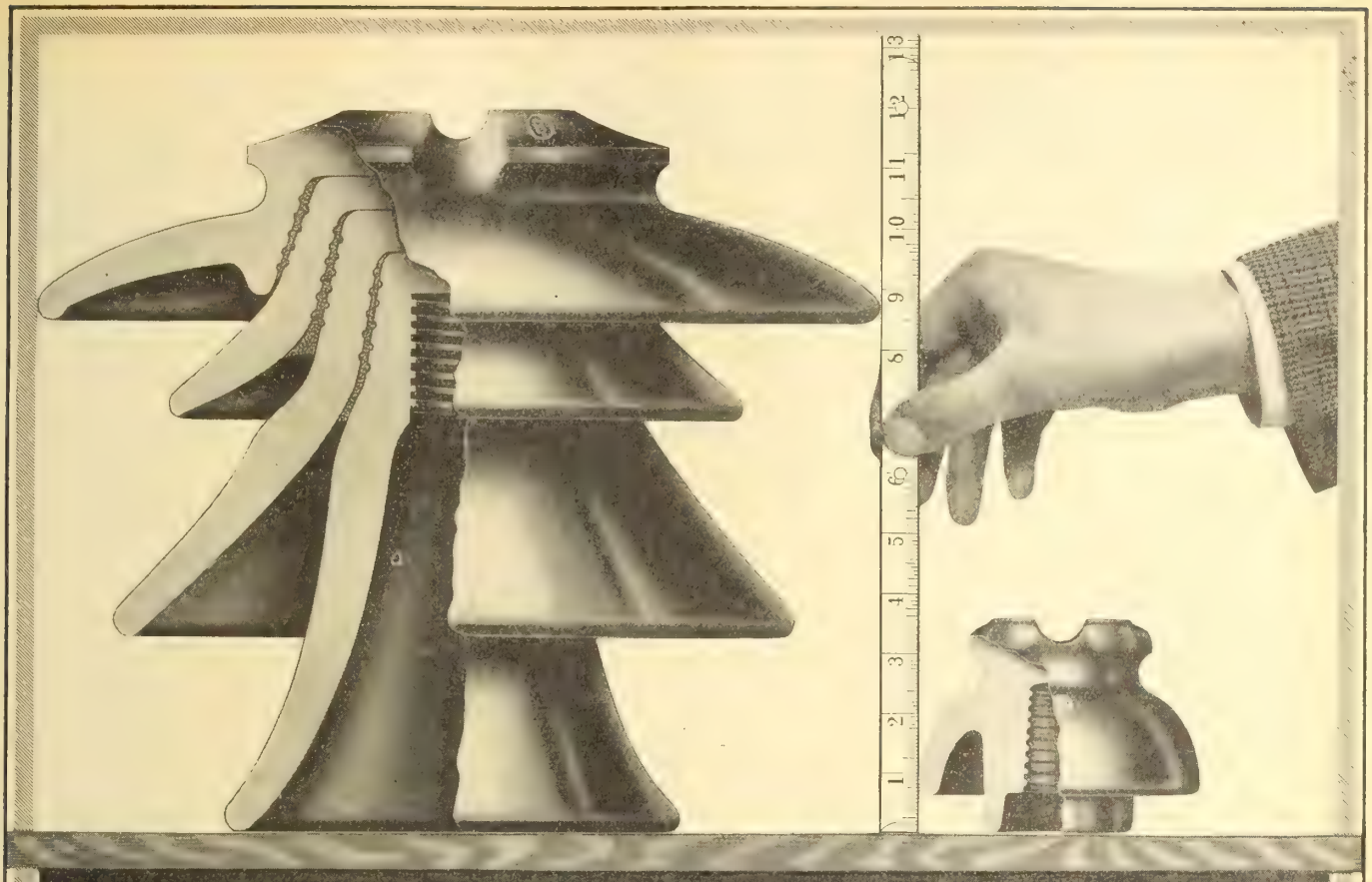
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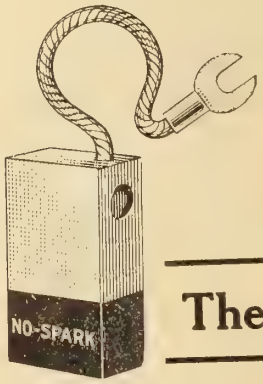
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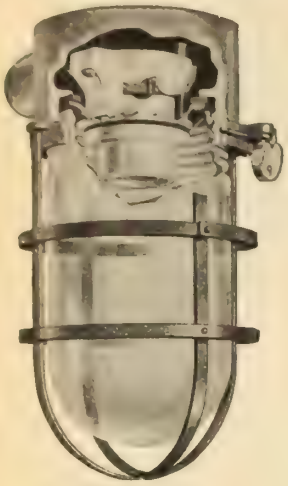
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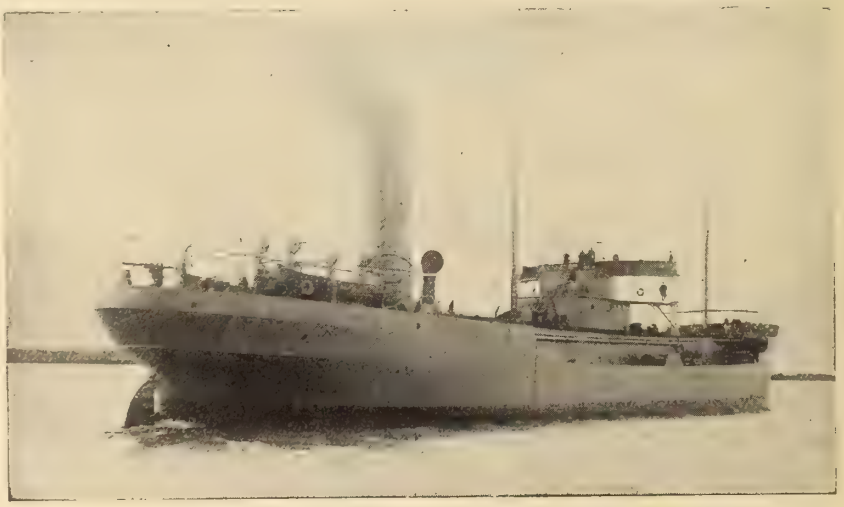
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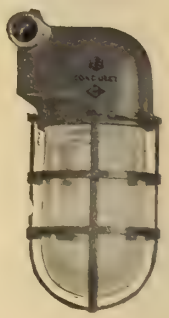
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Vol. 27 Toronto, December 15, 1918 No. 24

Are Canadian Members of International Joint Commission Sufficiently Alert to Dominion's Interests

In accordance with usual practice the International Joint Commission has published an opinion in support of its interim order in the St. Lawrence River power case, referred to in our issues of September 15 and October 1. This opinion was prepared by Mr. Justice Mignault of the Supreme Court of Canada, and outlines the history and scope of the application, describes the locality, analyzes the evidence submitted regarding the effect of the proposed submerged weir, and so on.

Treating first the jurisdiction of the Commission to deal with this matter, the report advances a number of arguments from which the conclusion is drawn that "this sufficiently disposes of the objection that the Commission is without jurisdiction, which objection, in the opinion of the Commission, is groundless."

Referring then to the matter of a decision regarding the erection of the weir itself, Mr. Justice Mignault notes that too short a period of time was allowed in which to consider the matter from all sides. "A sudden emergency," he said, "had arisen," and he argues that the order is so framed that "no rights of either country or of any of its citizens can possibly be jeopardized by its action" since "the submerged weir is approved 'merely' for a term of five years or until the duration of the present war, whichever shall last occur." He does not think there is any ground for the fear expressed by Hon. Mr. Guthrie, that "if it goes in it will never come out," although doubtless Mr. Justice Mignault is fully aware of the conditions existing, for example, at Niagara Falls, where the cry of "vested rights" in the United States has made it impossible to recall electricity developed on the Canadian side and exported to the States, though the exigencies due to war demands have made it just as urgent, doubtless, as have the requirements of aluminium for which the weir in question is being constructed.

There is one point too that Mr. Justice Mignault seems to almost studiously avoid. That is the fact that the work for the weir was well on towards completion before any application was made to the Joint Commission. This fact is called attention to in a paper by Mr. A. V. White, printed in our issue of December 1, in which he used these words:

> "The St. Lawrence River Power Company is a subsidiary company of the Aluminium Company of America, which, amongst other activities, operates a large aluminum-producing plant at Massena, N. Y. The St. Lawrence River Power Company desired to construct works in the St. Lawrence which would, so far as possible, remove ice difficulties which affected their winter output, 25 feet deep by 150 feet wide, in the bed of the St. Lawrence River. Complementary to this excavation there was to be a large boom held by rock-filled cribs, some 30 feet square, sunk in the St. Lawrence River. Below the dredged channel just referred to, there was also to be constructed in what is known as the South Sault Channel—that is, the passage nearest the United States shore—a 'submerged weir,' which actually is a large submerged dam. **The work of channel excavation was undertaken and practically completed** under permit from the United States War Department, **without the matter in any way being brought to the official attention of the Canadian authorities."**

If the jurisdiction of the Joint Commission covers this matter, why were they not awake to the fact that treaty obligations were not being observed by the United States? Surely this Commission is very much to blame that a work of this nature could go on without their having knowledge of it.

As it turns out, the war is over before the weir is completed and the Commission have merely given the St. Lawrence Power Company a gift, for five years, of whatever advantage the weir may prove to them in developing their industries. Surely there is a limit to liberality.

On both these counts we cannot see but that the Canadian members of the Joint Waterways Commission were guilty of being over-ruled, (perhaps over-awed), by the powerful interests against which they were supposed to be contending for Canada's interests.

Canadian Reconstruction

The Canadian Reconstruction Association, Sir John Willison, president, are publishing a number of valuable pamphlets on various phases of reconstruction work, one of the most valuable of which deals with the organization preparations that Great Britain is putting forth.

Organization, co-operation and combination are the guiding principles in the remarkable preparations which Great Britain is making for reconstruction. In the industrial, commercial and financial world the common impulse is towards the close association of banking, trade and business interests. A new industrial machinery is being created, so constructed that Great Britain will be able to maintain and improve its commercial position in the face of intense and highly organized competition.

The United Kingdom is considering changes in economic policy which may have far-reaching influences on world affairs. It is correcting surely the mistaken policies of the

which left it dependent upon other countries for essential commodities. Not only are new basic industries being established. The impetus lent to land cultivation by government and public activity has gone far to correct the dependence of the United Kingdom upon other countries for foodstuffs. It is estimated that for this year sufficient food will be produced to feed the population for 40 weeks as against provision for 10 weeks before the war. The area under wheat is now one and a half times what it was in 1914. The supply of home grown cereals in 1917 was more than 850,000 tons greater than the previous year, and the potato crop showed an increase of 3,000,000 tons. By the middle of February this year some 1,200,000 fresh acres had been brought under the plow in addition to the fresh acreage recorded in 1917. At the end of May, the Director-General of Food Production for England and Wales published an interim report on the result of the year's campaign for increasing home grown supplies. It estimated that the area of land under corn crops this year in the United Kingdom will be more than four million acres greater than that of 1916, and that the acreage under potatoes in England and Wales alone will be 50 per cent. larger than in 1916. Both these figures would constitute a record in the history of British agriculture. They do not take into account the produce of allotments and private gardens, of which the former have increased in England and Wales by not less than 800,000 since 1916. Much of the greatly increased production is due to the work of women; 316,000 being employed on the land, of whom 300,000 are village women, and 16,000 in the land army. Indeed, not only agricultural but industrial and national life have been effected by women war workers who are now estimated to total 4,500,000, of whom nearly 1,500,000 are doing men's work. No fewer than 1,000,000 are employed on munitions, while many thousands are to be found in banks and financial institutions, stores, shops, railway employment and other occupations.



The pamphlet deals with various phases of industrial life under the following headings:—industrial policy, raw materials, combination urged, greater markets, general trade policy, export trade plans, metal bank authorized, organization of reconstruction committees, scientific research, bank amalgamations, fiscal policy, necessity for tariff, protection advised, imperial preference.

This is the first of the series to be issued by the Canadian Reconstruction Association, dealing with measures being taken in other countries to meet after-war conditions. The signing of the peace agreement will undoubtedly be followed by a period of intense commercial rivalry. In Great Britain, the United States, France, Japan, etc., co-operation and combination are the guiding principles of the preparations which financial, industrial and business interests are making with their governments for the coming trade struggle. It is essential that like preparations and like co-operation should be pushed forward in Canada without delay.

Montreal Electrical Luncheons

Mr. W. G. Mitchell, described the natural resources, climatic characteristics and trade possibilities of Siberia at the Montreal Electrical Luncheon, on November 27. Siberia is just now in the public eye and Mr. Mitchell, who has just returned to Montreal, after two years in European and Asiatic Russia, was able to give a large amount of information as to that comparatively little known country. He remarked that the natural resources and physical features were almost identical with those of Canada, but there was this great difference —Siberia had no water powers, so that hydro-electric developments like we possess are impossible. The climate was perhaps a little more severe than in Canada; the summer temperature averaged 70 degrees and sometimes went to 105 degrees, and in winter the average was 10 degrees below zero.

There were no limits to the mining possibilities, the deposits of coal, copper and gold being enormous. Lumber and fur were also great assets; the country had very large supplies of pine, spruce maple, birch, walnut and oak. In his opinion Siberia has a fine future—its possibilities could not be exaggerated.

"Electricity and Surgery" was the subject of a talk by Dr. G. Fisk, at the Montreal Electrical Luncheon, on December 4th. It was a most informative speech, touched with incidents which had come under the doctor's observation. He referred to the great landmarks in the history of surgery, the discovery of anesthetics, the antiseptic and aseptic treatments, and the last, the important part which electricity was playing in surgery. In this connection Dr. Fisk alluded to the use of the X-rays in diagnosis, and also described the mercury vapour lamp, which was being used in sterilizing the skin, in skin diseases, in improving nutrition, curing rodent ulcer, and in cleansing infected wounds. The ultra violet rays, X-rays, and radium rays stood in the order named as regards intensity, and here, as in the case of the Hertzian waves, there were vast fields for investigation by electricians. Electrical heat was also being extensively employed in surgery. Massage had come into its own during the war and should be employed in combination with electricity.

Dr. Fisk concluded with a consideration of what he termed the greatest force of all, the electro-magnetic force of human personality, which was so freely cultivated in the East. Western men had the faculty of devising machinery, but little skill in cultivating the mental power.

Britain's Effort in the War

On Friday, November 6, the Electric Club of Toronto, was honored by having as its guest and speaker, Hon. Dr. Cody, Minister of Education for the Province of Ontario, who has recently returned from a visit to the Old Land and the battle-fields of France and Flanders. Dr. Cody spoke on Britain's effort in the war, and seldom, if ever, we are sure, has the club listened to as inspiring or gripping an address.

There was no need for apology, said Dr. Cody, for speaking to a group of electrical men on the subject of war, for the war could never have been waged as it has been without electricity. The development of artillery fire to its present efficiency and its co-ordination with infantry advance would have been impossible without electricity. By its use the headquarter's staff is advised, within a few minutes, of the happenings up and down the line. The submarine is directly the result of electrical appliances. And so, from the motor lorry up to the aeroplane, we find that electricity has played a tremendous part. Indeed, the present struggle is a warfare of gasoline and electricity.

Dr. Cody said he would not stop to speak of the achievements of the Canadian corps, except to say that it was excelled by no corps on the Western front. Everywhere, too, Canadians were found occupying places of distinction in other British armies. Col. Chas. H. Mitchell was possibly the best intelligence officer in the whole army. Col. W. G. MacKendrick had won himself high distinction as a road builder. Gen. Ed. Morrison, of Ottawa, formerly a newspaper man, was one of the foremost artillery officers on the western front, as was also Professor McNaughton, of McGill University, who, it was said, had been instrumental in practically revolutionizing artillery practice in that field. General Ross, of Kingston, a medical man, was offered the position of Chief Medical Director of the Fifth British Army. And so, everywhere, Canadians were holding positions of honor.

But it was of what the old Mother Land had done that he wished to speak, because there had been most insiduous propaganda on this continent that England would fight to the last Canadian, or to the last Australian.

The effort of the Motherland could be divided into three elements—the effort of the army in the field, the effort of the army at home, and the effort of that power, so salient and seemingly remote, but at the same time omnipotent, the British navy.

Regarding the British army, it was interesting to note that 75 per cent. of the total was supplied from the United Kingdom, while 12 per cent, came from the Overseas Dominions, and 13 per cent. from India. When we begin to analyze the contribution of the United Kingdom, we find that England gave 60 per cent., Scotland, 8 per cent., Wales, 3 per cent. and Ireland 2. So in point of the number of men who have borne their part in the struggle, the Motherland has given her share. Leaving out India, and including only white troops, there came from the United Kingdom 85 per cent. of the men raised and the casualties were 86 per cent. of the total, while we overseas recruited 15 per cent., and our casualties were about 14 per cent. Therefore it is not fair to say that England would fight to the last Canadian, when one thinks of the army she raised—up to the end of 1917, seven and a half millions, and up till August, 1918, eight and a half millions. That army at the beginning was small, but that little force of 160,000 men was the most highly trained in the world; none were so perfect in discipline and endurance. It was by a wonderful feat of transport that they were landed in France in two weeks. Eighty thousand of them were thrown in at Mons against two German army corps, later augmented by three additional army corps, and supported by innumerable artillery. They were out-numbered and out-gunned and they had to retire, fighting grimly all the way. At Le Cateau, they fought a rear-guard action under General Smith-Dorrien and gave the Germans a beating, making it possible to retreat in good order to the Marne. It was the endurance of that little British army that made the victory of the Marne possible. At Mons, too, the British army won glory enough to last for an eternity, but no more was said about it in the British papers than might have been said about a sham battle on Salisbury Plains. Then there was the first battle of Ypres in the terrible Ypres salient, perhaps the worst part of the whole western front, and in that winter the first British army held the Germans while Kitchener's first hundred thousand were in training, against tremendous odds, fighting at times spaced ten to twenty feet apart. "Do not, on this continent of effervescence and advertising, let us misunderstand what the race from which we are sprung has done."

Wide Scope of British Activities

British troops have carried on campaigns not only in France and Flanders, but in Italy, in Egypt, in Palestine, in Mesopotamia, in the Balkans and in Persia, and at Archangel, too, they landed a force to save from the Germans and the Bolsheviki, stores which rightly belonged to the Allies, besides the operations which conquered the Germans in East and South-West Africa. All over the world the British army has waged its conflicts, sometimes, indeed, with reverses, but while Britain may lose battles, she does not lose campaigns. The battle she always wins, historically, is the last battle, and and if the armistice had not been signed at the time it was, the whole Geramn army, practically, would have been forced to surrender, but Foch did not cherish the desire, or at least, did not urge the point to win the most brilliant and striking victory in the field in the long course of miltary achievement. He gave up that victory that he might spare the lives of his men, when he secured the same result in a less costly and spectacular manner.

The army in the field was made possible by the army at home. First of all Britain found that she was hopelessly unprepared in guns and munitions. We were firing shrapnel until May, 1915, when it was found that only high explosive shells would do the work. Then Lloyd-George took hold of the Ministry of Munitions, reorganized it and put some of his own energy and enthusiasm into it. That was the turning point of the war on land; government arsenals multiplied apace, private concerns all over the country took up the manufacture of munitions, and controlled industries in which the government was a partner increased a hundred fold. Perhaps the most marvellous of all the plants created was that at Gretna Green, the largest cordite factory in the world. This whole plant, including two towns within its confines, extends for a length of about ten miles, and of its working force, possibly 90 per cent. are women and girls.

How was this triumph attained so that Britain had shells enough and to spare. It was the British genius for organization—a genius of which we thought Germany had a monopoly—the biggest mistake we ever made—that made it possible in the first place. The other explanation was the spirit of the British women. Women of high degrees and low degrees and no degrees at all, went in and worked like daughters of Titan, carrying out operations of which one could not have believed them capable.

And as to finance, Britain, in the first year of the war, financed her overseas Dominions to the tune of one billion dollars, and she has financed her allies on the continent to the extent of eight or nine billions. Her war debt, when all is over, it is estimated, will be 50 billions. When her debt

[illegible] she had raised 25 or 26 billions by loans, and 4 billions by taxes. Britain has been paying taxes that would make us turn pale or shoot the tax collector.

How what about the ration? Her people endured the most rigorous ration that there might be space in British ships for American troops. The pasture land, much to their disadvantage, was used for the production of wheat that France and Italy might be fed. Fifty per cent. of France's coal supply came from Britain, and she lent to France one million tons of shipping. She was the carrier, clothier and universal provider of her continental allies.

The Grand Fleet

Then there was the third great contribution that Britain made. Dr. Cody said that even after he had been all the way through the five British armies and had seen the great munition plants and aerodromes, he still felt that there yet remained the climax of it all. So he hied him to the old city of Edinburgh and down the Firth of the Forth, and there he saw stretching for twenty-five miles out to sea, the Grand Fleet. We cannot reproduce in print the word-picture which Dr. Cody drew of this great sight. There were the mighty super-dreadnaughts, like the Queen Elizabeth, Admiral Beatty's flag-ship, and the Iron Duke, which had been Admiral Jellicoe's flag-ship; there were the Malaya and the New Zealander, which had been contributed by the countries of which they bore the name; there were battle-cruisers, like H.M.S. Lion, which had been battered in the Jutland fight; there were newer and lighter battle cruisers, which had sacrificed armament for speed—ships whose bows cut the waves like razors; and there were the indomitable little destroyers. At such a sight, one thought of what sea power had meant to the world, of how empires had fallen when they had lost control. One thought of the Armada, and of Napoleon, and then of him—what shall we call him? —William the Last. On every occasion it was sea power that counted most, and so far as Europe was concerned, it was British sea power that kept the ocean free. This has made it impossible for German battleships to prey on the commerce of the world, has made it possible for 20 millions of British troops to be conveyed, back and forth, to the battlefields. This was the fleet that was responsible for the carrying of supplies, which baffled the German effort to choke the Allies by her submarine warfare, which convoyed two million Americans to the battle area. It was the fleet that sounded the knell of German domination. Britain held her dominion on the seas and by the seas, said Dr. Cody, and she will not, please God, forego her right and her privilege to maintain her supremacy on the sea. For "The sea is His and He made it," and can we not reverently add, "and Britain has kept it free."

Another Big Night for the Toronto Section of the A. I. E. E.

More than one hundred and twenty members and friends of the Toronto Institute of Electrical Engineers attended a meeting at the University of Toronto on Friday, December 6, to hear an address by Dr. Saul Dushman. Not only did the Toronto membership turn out in force, together with a number of professors and students of the School of Practical Science, but at least half a dozen ladies were present, attracted by what proved to be a most fascinating address delivered in inimitable style. Dr. Dushman selected for his subject 'Some Recent Applications of the Electron Theory," and although his main intention was to deal with the development of the kenotron and other hot cathode apparatus, he began his talk with a resume of the whole field of vacuum and Rontgen tube research, which has occupied such advanced scientists as Crookes, Thomson, Ramsay and others. Great improvements in the means of exhaustion have provided much greater degrees of vacuum than the early investigators ever dreamed of, and at the same time the practical applications of the electron theory have been widely increased.

The kenotron is a vacuum tube having its cathode heated by a local battery circuit and has been used by the thousand by the United States Government for the equipment of aeroplanes as part of their wireless plant. The instrument itself provides a convenient rectifier and source of high voltage direct current. The well-known Cottrell process of smoke precipitation by electronic discharge employs a group of kenotrons as its power plant. Some photographs taken of a roundhouse of the P. & R. Ry. at Philadelphia showed in remarkable fashion the effect of this plant in clearing smoke.

The apparatus which Dr. Dushman brought up with him from the General Electric laboratory at Schenectady enabled a number of interesting demonstrations to be made which quite substantiated the laws believed to govern the current discharge from a hot cathode with different temperatures and voltages. Furthermore, many slides which were shown on the screen helped to make the treatment of the subject most complete and comprehensible to the layman.

It is a tribute to the importance of the Toronto Section that a physicist of Dr. Dushman's standing should take the trouble to make a six hundred mile trip in winter for the purpose of addressing a Section meeting. Nevertheless, electrical engineering is perhaps the most active and important profession in Ontario, and the suggestion that Canadian electrical engineers should have their own technical institute, which has been heard in several places, has been voiced not without reason.

On January 17, 1919, the next meeting of the Toronto Section will be held in the Engineers' Club, when the privilege of an address from Mr. Roland C. Harris, Chief Commissioner of Works, will again bring the members together. Commissioner Harris has promised to talk about civic engineering in general and some engineering features of "The Bloor Street Viaduct" in particular.

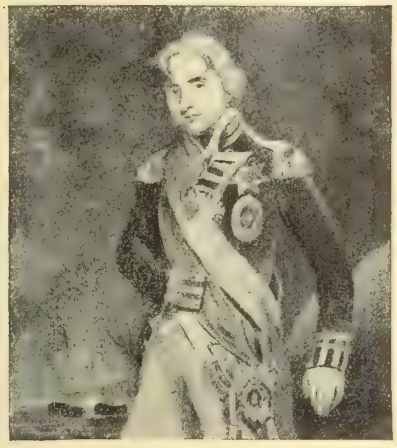
Coal Consumption in Electric Plants

The Hydro-electric Power Commsision of Ontario have issued a report on the rate of coal consumption in various electric generating stations and industrial establishments in Canada and the United States. The basic data for this research has been selected only from those relating to such electric power stations as use coal for fuel and which use it entirely for generating steam. Special effort has been made to eliminate all factors which would in any wise be irrelevant to the purpose in hand. Thus, all stations which, in part, use wood, oil or fuel other than coal; stations using producer gas and those employed for standby or auxiliary purposes, have been disregarded. Most of the figures given are averages for the past five years and average figures for different sizes of stations have been deduced therefrom. The report contains a quantity of tables, curves and charts.

Mr. J. E. Aldred, president of the Shawinigan Water and Power Company, states that they are closing the biggest year in their history so far as volume of business is concerned. While the actual figures have not been made public it is said they will be entirely satisfactory to the shareholders.

The Matane Lumber and Development Company, incorporated with a capital of two million dollars, takes very wide powers, including the acquisition in the counties of Matane, Rimouski, Gaspe and Bonaventure, P.Q., of water powers and the right to generate, distribute, and employ electric power.

1805 — 1918



Admiral Lord Nelson

HISTORY's greatest sea spectacle in 1918 came within thirty days of the anniversary of the world's greatest sea battle. Trafalgar was the world's greatest sea fight because it marked the coming downfall of one more despot of mankind. Napoleon failed to make Paris the Capital of all Europe because he never could invade England. The little guns that hurled cannon-balls from the "Victory" in 1805 were the fore-echo of the guns of Waterloo in 1815, and of the silent surrender of the Kaiser-navy 103 years later. Had Nelson never flung his fleet of wooden tubs from the forests of England at the ships of France and Spain, Wellington's great little armies might as well never have marched. We read that in the action at Trafalgar the four ships "Victory," "Temeraire," "Redoubtable" and "Fougeux" fought so close that they made almost a single deck. Sabre and musket, man to man they fought, and there was Nelson in the midst of them, as he always was. From the mast of the "Victory" still fluttered in the smoke the rags of that immortalizing signal, "England expects that every man this day will do his duty." When Nelson spoke in the name of England it was with a passion that not to obey him was not to know the glory of duty. Master of naval strategy and tactics, he never had time to write a book about it, because he was too busy fighting for England. He knew nothing of politics, like Wellington; nor of statecraft, like Napoleon. But he knew the swish of the sea, the roar of the guns, the coast-lines of Europe from the Baltic round to the Aegean; and wherever he went—after whatever enemy—sailor, daredevil fighter, poet in action, terrible and beloved, he carried with him like a song, "England, My England." Trafalgar was his last word to Napoleon that England must conquer because she could not be invaded.

"Mighty seaman, this is he,—was great on land as thou by sea," wrote Tennyson in his Ode to Wellington. A musket ball from the crosstrees of the "Redoubtable" killed Nelson. But the death of Nelson was the life of England and duty, as Trafalgar was the first sure sign in 1805 of the liberation of all Europe.



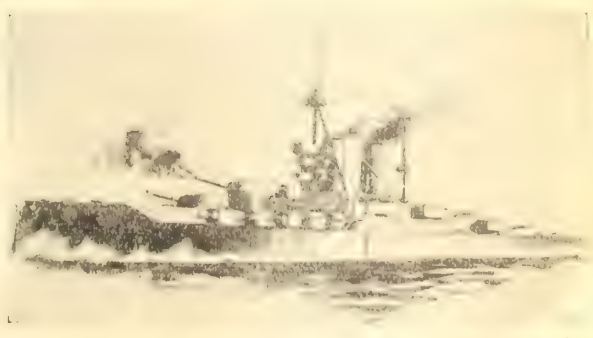
H.M.S. "Victory"



Admiral Sir David Beatty

THREE times in four years he had fought them. He had hoped to fight them again—and to a finish. But here in the North Sea, November 21, 1918, was the finish without the fight. Seventy-one Kaiser-ships of the line steaming up the lane of a great nation's navy. Five hundred great guns—any of them at ten miles could have riddled all Nelson's fleet of tubs in 1805—Never a shot! It was his answer to that day when the High Seas Fleet put to the North Sea in 1914 with the King's message. "Capture or destroy the enemy." Perhaps he remembered that twenty days afterwards; he potted five German cruisers off Heligoland; and then he began to wait, prowling in the fog, looking for more ships from Kiel—till on January 24th, 1915, he sank the "Bluecher" and smashed the "Seydlitz" and the "Derflinger" in that 100-mile run—back to Heligoland, when all the "Lion's" gunners had to aim at was a target of funnel-tops and smoke, the size of a threepenny bit. One year and three months more he waited; till May 31, 1916, when in the battle of Jutland the Rear-Admiral's Fleet came at the bulk of the Kaiser-navy that ran when Jellicoe's supports came up—back to Heligoland. Rear-Admiral became Commander-in-Chief and waited again; shuffling his great mystery fleet back and forth in Scandinavian mists, nobody unofficially knew where—till the morning of November 21st, 1918, he put to sea in the "Queen Elizabeth." What a sight greeted him! The dark-grey lines of the Invincible Navy in the smoke; the six-mile lane; the fog lifting; and out of the low mist from the region of Heligoland they came—abjectly to surrender!

It was "Der Tag" Dead March of the Kaiser-navy; more magnificent in its fitting humiliation to a degenerate race than any surrender of an army. Never a shot, nor a shell, nor a shout. In a great grey silence of miles of monster ships the Kaiser's ensign was hauled down and the sullen sea drama was over. Was Beatty happy? Heaven knows. Three times he had fought 'em, doing his bit to bring one more despot of Europe to his knees. He had hoped to fight 'em again. Here was the finish without the fight. What a finish!



H.M.S. "Queen Elizabeth"

45,000 Kw. Cross-Compound Steam Turbine

Separate High-Pressure (Single Flow) and Low-Pressure (Double Flow) Elements Each Coupled to Its Own Generator

There has recently been put in service in the Brunots Island power station of The Duquesne Light Company, at Pittsburg a 45,000 kw cross-compound turbine-generator unit which is described in the Electric Journal. The cross-compound idea is not new, of course, even in steam turbine practice, a most successful example being the three 30,000 kw. units which have been in operation for some years in the 74th street power station of the Interborough Rapid Transit Company, New York, while in the same power station has just been installed the largest turbine yet constructed, a three-cylinder, cross-compound unit of 70,000 kw. capacity.

This new 45,000 kw. Pittsburg unit consists of separate high and low-pressure elements, each coupled directly to its own generator. The high-pressure element is a single-flow, reaction-type turbine, running at 1,800 r.p.m. and expanding to atmosphere. The low-pressure element is a double-flow turbine of the same type, running at 1,200 r.p.m. and expanding to vacuum.

The reason for dividing a large capacity turbine into two or three elements running at different speeds is obvious. A certain quantity of steam has to be passed, which may increase in volume one hundred and fifty times, between inlet and exhaust, and drop five hundred degrees in temperature. This means beginning with very short blades on a small drum and ending with very long blades on a large drum. If these are all put on one spindle it is inevitable that considerable compromise must be made at the extreme ends, with a resultant loss in efficiency; and furthermore, the wide range of temperature in the same cylinder may cause troublesome distortions. With the use of two or more cylinders, the expansion is divided, making it unnecessary to resort to a compromise in blading distribution or velocities. The high temperature can be confined to one cylinder of smaller size and simpler construction, and not endanger the necessarily large size low-pressure sections. This may result in a more expensive construction, but is warranted by a greater efficiency and dependability.

Steam is supplied through a 24 inch main to the high-pressure turbine. It passes first through an automatic throttle valve, a steam strainer, and a governor controlled primary valve, and then enters the high-pressure cylinder from below. The steam chest, strainer, etc., are spring supported and are carefully aligned to remove the possibility of outside forces being exerted on the turbine cylinder, sufficient to cause distortions when the parts are expanding and contracting under load. Steam is exhausted from the opposite end of the high-pressure cylinder at about atmospheric pressure, when running at full load. The exhaust steam from the high-pressure cylinder passes into a cast iron overhead receiver pipe, which leads to the center of the low-pressure turbine where it divides, flowing either way into surface condensers below.

In connection with the marked increase in the capacity of steam turbines of late years, it is interesting to note that the size of the turbine has not increased in proportion to its capacity, owing to the development of the high-speed alternating-current generator; whereas the steam pipes have proportionately increased. This presents the problem of so arranging the header, that it will have a maximum flexibility at the point of contact with the turbine, and will not disturb the alignment or distort the cylinder by its expansion or contraction.

A 66 inch gate valve is located in the receiver pipe midway between the two turbines, for the purpose of isolating the one from the other in case of a shut down. Provision is made for the valve to be closed automatically in case either element should get into difficulty, and the necessity arise for its immediate removal from the line, without disturbing the other. This is accomplished by a specially equipped governor on the low-pressure turbine, which will be described later.

The turbine is designed to operate with 200 lbs. gauge steam pressure, 200 degrees superheat at the throttle, and an absolute pressure in the exhaust of one inch of mercury. The pressure in the receiver pipe is 12 lbs. absolute at 30,000 kw. The generators are each 23,600 kv.a., three-phase, 60 cycles, excitation being provided separately. A double condenser is provided containing 28,000 sq. ft. cooling surface in each shell and capable of maintaining a 29 inch vacuum with a load of 35,000 kw. and 60 degrees cooling water.

Flexibility in Operation.

This big unit is not radically different from the others of the same type. A distinctly new feature is the automatic device for cutting out either turbine if, for any reason, its immediate removal from service becomes necessary. By this means all the economic advantages of a 45,000 kw. machine are obtained with the flexibility of a 22,500 kw. that is, it is necessary to carry in reserve only 22,500 kw. rather than 45,000, as would be the case if it were a single cylinder or tandem machine. Each turbine and generator rotor is supported in its own bearings, so that four bearings are required for each element. They are heavy cast iron shells lined with babbitt and split horizontally, the upper half fitting into the lower, to prevent any side movement between the two halves. The bearings are self-aligned, being supported on spherical keys with sheet metal liners of definite thickness underneath, for horizontal or vertical adjustment. Oil for lubrication is

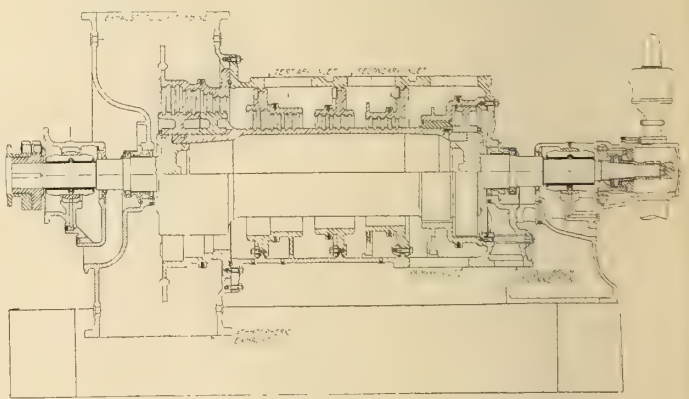


Fig. 1—Section through high-pressure single-flow turbine

admitted to the bearing casing at the bottom, is conducted through internal pipes to the top and distributed over the length of the journal through an oil groove. The sides of the bearing are eccentrically relieved for a space of about 35 degrees above and below the center line, to within an inch of each end, thus providing a reservoir of oil along each side. The journal is thus supported on an arc of about 110 degrees. It has a peripheral speed of 75 feet per second and a pressure of 110 lbs. per sq. in. on the projected area of the bearing.

Both turbines are equipped with Kingsbury thrust bearings capable of taking load in either direction, though when

running the thrust is toward the generator. Under normal operation they are loaded to about 300 lbs. per sq. in., but are capable of safely carrying twice as much. The peripheral speed is about 100 feet per second. These bearings are not only immersed in oil, but are supplied with a circulation of fresh oil through internal passages which deliver it nearer the shaft. The couplings are of the flexible pin type, providing sufficient flexibility to take care of any ordinary misalignment due to improper setting or to deflection of shafts.

The shafts are sealed with a water-gland which operates on the principle of a centrifugal pump, maintaining a water seal with a head greater than atmosphere, thus preventing air from leaking through the water filled chamber and into the exhaust. A steam seal is provided in an additional chamber along side the one in which the paddle wheel revolves, into which steam is admitted at a pressure of about five pound gauge, or a little above atmospheric pressure when starting up. This prevents air from leaking through the gland into the turbine while it is being brought up to speed or until the gland becomes operative. When running the steam is turned off.

The high-pressure turbine is of the single-flow reaction type. The entire cylinder or casing except the exhaust end is made of cast steel. The internal blade rings are separate and bolted in place.

High-pressure steam is admitted to the cylinder from below through the primary inlet, as shown in Fig. 1. It passes through the successive rows of blades and out through an overload exhaust to the low-pressure turbine. This particular turbine is arranged to carry 30,000 kw. on the primary valve with 175 lbs. steam and 100 degrees superheat at the throttle and 28.5 inches vacuum in the exhaust. For a load between 30,000 and 40,000 kw. steam is admitted through the secondary valve, thus by-passing the first five rows of four inch blades and entering the second stage which has five inch blades. This gives greater capacity but at a reduced efficiency. Similarly for loads above 40,000 kw. steam is admitted directly to the third stage, starting with six inch blades. The limit of capacity is approximately 50,000 kilowatts.

There are 24 moving and the same number of stationary rows of blades in the high-pressure turbine, beginning with four inch blades one inch wide on a 36 inch drum and ending with 10.5 inch blades 1.25 inch wide on a 50 inch drum.

The rotor is composed of three main parts, the body and two ends, besides which there are two blade rings on one end and two dummy rings on the other. The ends are pressed into the body on long taper fits and secured by tee-headed shrink links, making a thoroughly secure and rigid construction with a calculated deflection at the center of not over seven thousandths inch and a critical speed of 2,300 r.p.m. The normal speed being 1,800, there is left an ample margin to insure smooth running when properly balanced.

Low Pressure Turbine

The low-pressure turbine is of the double-flow type as shown in Fig. 2. Steam enters the center section and flows both ways, passing through eight rotating and eight stationary rows in each end, varying in length from six to eight inches, then passes into the exhaust chamber and down into the condensers below. As the load is divided equally between the high-pressure and low-pressure turbines at full load, the steam enters the low-pressure turbine at about atmospheric pressure.

The cylinder or stationary part is of cast iron and is composed of center and end sections, the blade rings being cut integral with the cylinder. The three sections are bolted and spigoted together and all are split horizontally. The upper three pieces are handled as one, the vertical joints never being disturbed after they have been once assembled.

The turbine rests on four supports applied directly below the horizontal joints, on each side of the exhaust chamber, and in line with the center of the exhaust opening. It is free to expand axially, sliding on these supports, with the turbine anchored to the inboard generator pedestal. A system of radial and axial stays in the exhaust chamber gives ample support for the spindle bearings and produces extreme rigidity in the whole structure, minimizing the possibility of distortions with change of load, or due to external pressure.

The low pressure rotor is composed of a central hollow drum rigidly secured to spindle ends on each of which is pressed two blades or discs carrying the low-pressure blades. The maximum mean velocity of the blades is only 515 feet per second which precludes the necessity of using other than a good grade of cast steel in the blade rings, as the rotative

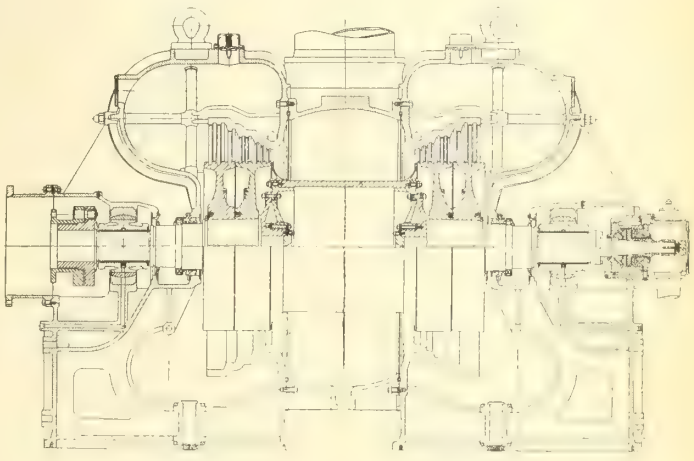


Fig. 2—Section through low-pressure double-flow turbine

stresses do not exceed 20,000 lbs. per square inch at 20 per cent. overspeed. This has a distinct advantage over a design containing special grade steels, which are not only hard to get, even in normal times, but in the use of which a certain hazard is always taken, through the possibility of an undetected flaw, or some part not being up to specification, and besides a little abuse in the way of improper heat treating on a highly stressed part may result in a costly failure. Owing to the double flow feature, ample blade area is provided to take full advantage of a high vacuum and still maintain a reasonable blade length in the last rows. Phosphor bronze blades are used, except in the last three rows of the spindle, which are drop forged steel.

Automatic Cut-out

One of the principal features of interest on this turbine is the means whereby, in case of necessity, either machine may be automatically or manually cut out of service without disturbing the other. Each turbine is provided with an overspeed stop governor which will shut off steam to that unit in case the speed should rise ten per cent. above normal. Each unit also has a speed control governor. The one on the high pressure turbine, which normally controls the steam supply to the whole system, is of the customary form. The governor on the low pressure element, while essentially the same, has some special features.

A gate valve is placed in the 66 inch receiver pipe, connecting the high and low-pressure cylinders, which is automatically closed by a hydraulic piston, under the control of the low-pressure governor, in case the low-pressure turbine should over-speed. The high-pressure turbine is provided with an emergency exhaust which will, in such an event, open to atmosphere through a relief valve, the turbine still continuing to carry load. Similarly if the two turbines are running together and the high pressure element should lose [illegible], steam will be shut off by its governor, when it will continue

with no load, or if it should over speed, the steam will be entirely shut off by the over speed governor. In either case, through lack of steam, the low-pressure turbine will slow down a certain percentage below normal speed, when the governor on the low pressure element will open the governor valve and admit live steam directly.

The governor on the high pressure turbine is adjusted for the usual close regulation of about three per cent. over the full range from no load to full load. The governor on the low-pressure turbine during this time must, of course, be inactive, neither admitting high-pressure steam through the steam chest, nor closing the valve of the receiver pipe. In this way, the travel of the low-pressure governor is divided into three zones:—the outer position, in which the gate valve admitting steam from the high is operated; the inner, in which is controlled the admission of high-pressure steam, when other source has failed; and the middle position, or neutral, where the high-pressure governor is controlling the system, and the low-pressure governor has no effect on the admission of steam, but is simply running idle.

It is desirable, of course, that the low-pressure governor should not be called upon to perform any of its functions, except in the case of an emergency, and in order that this position may be maintained properly by the switchboard operator, a system of signal lamps is arranged to show its position in the neutral zone. By changing the tension of the speed changer spring, the governor may be kept in its middle position, so that a normal fluctuation of frequency will not cause the governor to function. The spring on the low-pressure governor is designed to give a total speed range of twelve per cent. which is divided up as follows: Starting from the central position, if the speed rises four per cent. the governor is on the verge of tripping the low-pressure inlet valve. With a further rise of less than one per cent, the valve will be tripped shut, one more per cent, travel being provided

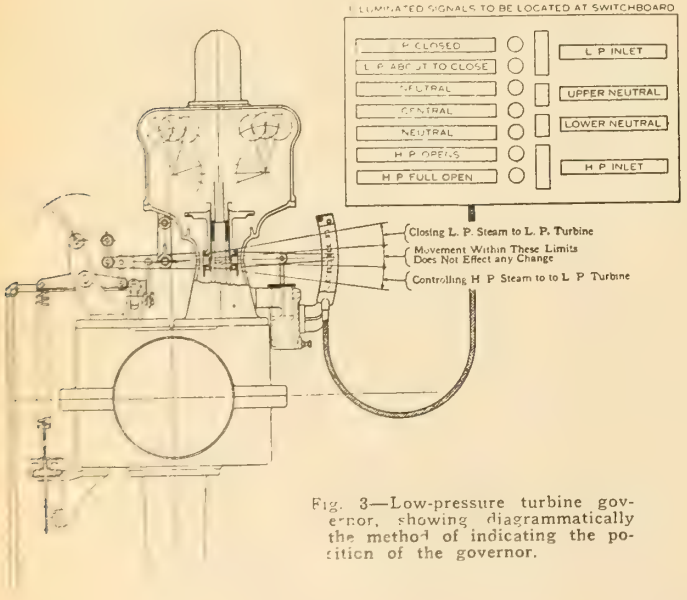


Fig. 3—Low-pressure turbine governor, showing diagrammatically the method of indicating the position of the governor.

for clearance. From the central position downward, should the speed decrease two per cent, the high-pressure valve will begin to open and will be full open after three per cent. more decrease. Another one per cent. is also provided at this end for over-travel.

The signal lamps in the switch board gallery, Fig. 3, are controlled from the low-pressure governor by a system of contacts operated by an extension on the governor level. As the governor moves between its inner and outer position this level travels across the contacts, registering its position on the illuminated sign.

Principal Features

To review the system briefly:—If the circuit breaker on the low-pressure element should open due to a short-curcuit, the turbine will speed up and close the steam inlet from the high-pressure cylinders. The high pressure turbine will continue to run, carrying its load and exhausting to atmosphere, while the low-pressure turbine, with its source of steam cut off, will fall in speed until reaching two per cent. below nor-

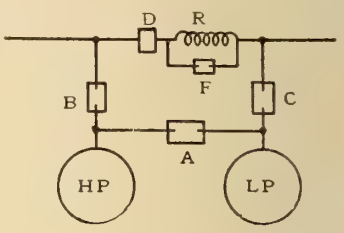


Fig. 4—Diagram of generator connections.

mal, when the governor valve will admit high-pressure steam. In the meantime, if the line has been cleared the unit may be synchronized and reconnected to the bus bars, the gate valve opened, and the low-pressure cylinder receive its steam as before. If the low-pressure turbine for similar reasons should overspeed ten per cent. and the automatic stop operate, it will result in the automatic closing of the high and low-pressure steam inlets, and the opening of the circuit breaker, and thus this half of the turbine will be entirely shut down. The high-pressure element, however, will continue to run non-condensing and carrying its load as usual.

If the circuit breaker on the high-pressure turbine should open and the load be dropped, the supply of steam to the system would diminish, and the speed would fall until the low-pressure governor valve opened, admitting high-pressure steam to carry load. The connection from the high to the low-pressure cylinder would remain open, the no-load steam on the high-pressure element continuing to help run the low. After the electric difficulties have been removed the high-pressure generator can be synchronized and placed back on the line and the load carried as before.

If the high-pressure turbine should overspeed ten per cent. through some local cause, and the automatic stop operate, the main throttle and governor valve would close, shutting off all steam to the system. The circuit breaker would open and the machine shut down. The speed of the low-pressure element would immediately drop until its governor valve opened to admit high-pressure steam to carry the load. In this case the steam seal on the high-pressure glands should at once be turned on to prevent an air leak into the system unless, however, the inlet pressure is kept above atmosphere. In case it is necessary to run the low-pressure turbine alone for any length of time, the gate valve in the receiver pipe should be closed.

Attached to each throttle valve and operated by it is a switch whose function is to operate the main circuit breaker. The throttle valve is tipped out by the emergency stop and in this way not only is the turbine absolutely isolated, but the generator also. The operation of the throttle valve by hand, however, does not operate this switch.

The low-pressure element, is served by two 28,000 sq. ft. surface condensers or a total area of 56,000 sq. ft. The condensers are spring supported, there being no expansion joints between the low-pressure turbine and condensers. They depart from the standard construction in that the circulating system of each condenser is divided into two parts, so that one half can be in operation, while the tubes in the other are being cleaned. Each condenser is equipped with two water

inlets and outlets, and also has two air off-takes, one on each side of the condenser shell. The condenser is supplied with 74,000 gallons of cooling water per minute, by three circulating pumps of the double impeller type. All the circulating pumps are turbine-gear driven. The air removal apparatus consists of two sets of Westinghouse-LeBlanc wet air pumps, each of which is capable of completely removing the air, so long as the leakage is normal.

The water supply for the air pumps is taken from a steel tank. Both sets of pumps discharge into one tank, and the air pump water is used over and over again. Of course this arrangement requires a certain amount of make-up water to keep the temperature of the air pump water down to normal. This is taken from the service line. The overflow from the air pump tank is ordinarily discharged into a sump. Due to the fluctuating water conditions at Brunots Island Station, booster pumps were also supplied in order to take care of the overflow during periods of high water in the river. The condensate is removed by means of centrifugal pumps, each of which is capable of handling the maximum condensate. The air and condensate pumps are driven by the same turbine, but are not on the same shaft, there being a coupling between the air and condensate pumps.

The two three-phase, 60 cycle, 12,000 volt generators are designed for the same output at full load. The one connected to the high-pressure turbine has four poles and runs at 1,800 r.p.m., while the one connected to the low-pressure turbine has six poles and runs at 1,200 r.p.m. In spite of this considerable diameter in speed the D^2L as measured at the outside diameter of the punchings, as well as the length of the core, is almost the same in both cases, it being but 3.5 per cent. higher in the low-speed generator. On the other hand, the D^2L measured on the active diameter and length of the rotor is 45 per cent. higher in the low-speed machine. The reason for the D^2L being nearly the same at the outside diameter is due to the fact that the high-speed machine has a considerably greater depth of punching back of the slots, because of the larger flux per pole per inch of length axially.

Each generator requires approximately 70,000 cu. ft. of air per minute for cooling. With this large volume of air, the air temperature rise, and the iron temperature rise are both comparatively low. The air is supplied from separate blowers, and the two machines require approximately the same pressure to circulate the needed air through them, this pressure being about 4.25 in. of water. All the air is washed before it enters the generators, thus insuring against clogging of air ducts and tending to decrease danger of burnout. Air to the amount of one and one-third times the weight of the generators passes through them per hour. Also approximately 1.4 times the weight of steam needed to drive the generators with full load of 40,000 kw., is required in air for cooling.

The stator insulation in the buried portion in both machines is mostly mica, and is capable of withstanding continuous temperatures of 150 degrees C. The rotor insulation in both machines also is mostly of mica, and is capable of withstanding the same temperatures as the stator. The stator coils of both machines have but one turn each, there being parts of two coils in each slot. That only one turn per coil is needed with 12,000 volts is due to the fact that the generators are so large, and a small number of turns in series is required to generate the total voltage. With one turn per coil, there is no danger of break-down between turns, which is an important item with over 200 volts per turn, and a breakdown between turns wouuld mean not only the destruction of the insulation, but would also probably be accompanied by great damage to the core. In order to reduce the eddy current loss in the stator coils to a point where the temperature will not become dangerous, the coil is well stranded, and the strands are transposed from one coil to the next, thus bringing the top set of strands of the first coil in series with the second set of strands of the second coil, the third set of strands of the third coil, etc.

In order to protect the generators in case of fire, arrangements have been made to inject steam into the air intake just below the entrance to the end bells and, in addition, there is provision for shutting off the air as soon as fire is discovered. This means has been found to be quite effective.

The generator fields were designed to have approximately the same exciting voltage at full load as that required by the other generators previously installed in this station, and with which this unit is to operate in parallel. This enables fairly efficient operation, as very little external resistance is needed in series with the field windings of the generators when an automatic regulator is used. It also permits the use of a common storage battery for emergency excitation of this and the other units.

The scheme whereby the two generators are paralleled is given in Fig. 4, in which A is a switch which is manually operated and is used only to connect the two generator windings together when the unit is started. When starting, with this switch closed, the fields of the two generators are excited so that the two units are kept in step from a standstill. When the machines are up to speed, the switch A is opened. D is a nonautomatic circuit breaker, R is a reactance, and F is a circuit breaker which opens in case there is a short-circuit on either side of the line. In case of a short-circuit the reactance R prevents a prohibitively high current from flowing from the second machine to the point of breakdown. B. and C are differential automatic protective devices for the two generators.

Accident Under Peculiar Circumstances

A rather unusual case is just now being tried before Justice Middleton in the non-jury assizes. The plaintiff, a woman, is suing the Toronto Street Railway Company and the city of Toronto for $5,000. It appears that she alighted from a street car at one of the intersections and in order to avoid a pool of water and a waggon belonging to the city she crossed the road and was struck by a car turning the corner in the opposite direction. The plaintiff contends that the street car should not have stopped at a point where passengers could not be discharged with safety and that the city should not have allowed the pool of water or its team to remain on the street at a point where passengers alight. The city contends that it was under no obligation to remove the water, that the team was being used in a reasonable manner and that the accident was due to the plaintiff's negligence. The railway company also denies liability.

Re-Construction Work in Sherbrooke

There were two typographical errors in the article on Hydro-electric Reconstruction at Sherbrooke, published in our issue of November 15. On page 31 it was stated that the Frontenac street power house plant consisted of two water wheel generators of 25 kv.a. each. This should have read '625 kv.a. each." On page 32 reference is made to the Rock Forest Transmission line and the three Canadian Westinghouse transformers are described as of 533 kv.a., 6600-2200 volts. This should have read "633 kv.a., 6600-2200 volts."

The fare on the Boston Elevated Road has been increased to 8 cents. In August last it was raised from 5 to 7 cents. School children will be able to purchase tickets at the rate of 5 cents each.

Joint Usage of Poles—a Workable Economy

By T. N. Bradshaw*

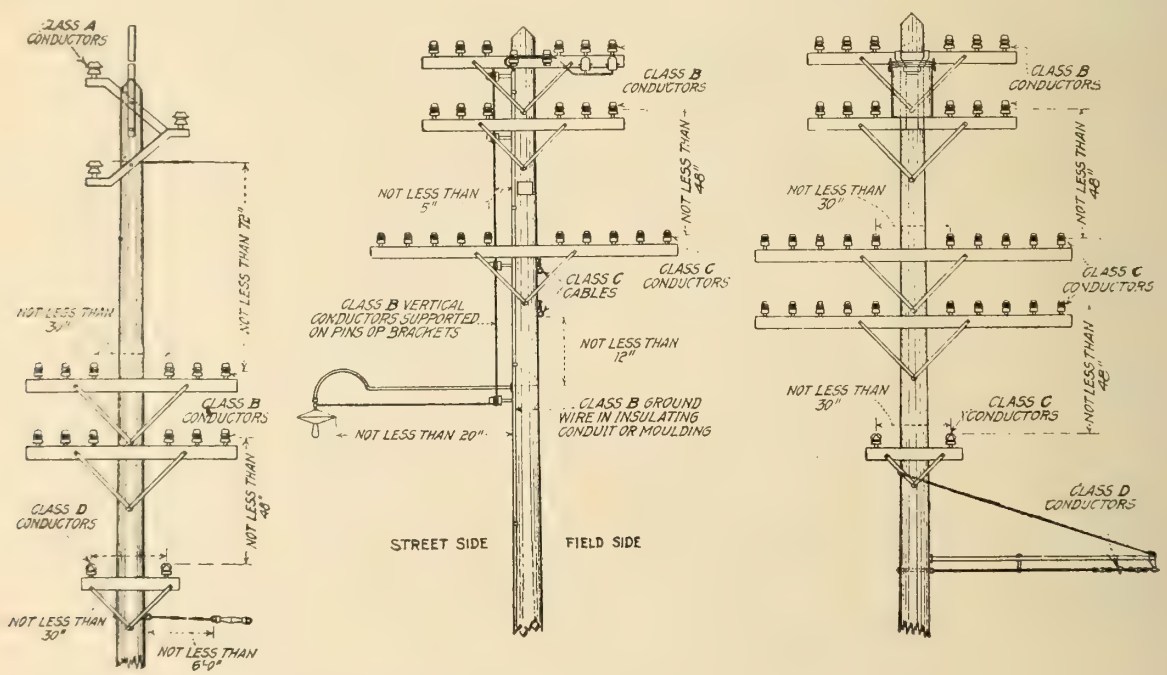
Two or more lines of poles erected on the same side of the street or highway are not only unsightly but represent an economic loss and a waste of timber. Where the wires on such conflicting lines are carried at or near the same level a serious electrical hazard to persons or property is liable to be created owing to the proximity of the wires of different classes and the liability of contact between them or the possibility of employees working on one class of wires coming in contact with another.

The most practical way of eliminating the losses and hazards referred to in connection with lines located on the same side of the street appears to be a properly constructed joint-use line having a well-defined space for the wires and fixtures of each occupant. These spaces should be separated from one another by an ample vertical clearance space. They should also be provided with a suitable climbing space so that employees of the various companies using the poles can ascend and descend them without coming in contact with the wires through which they may have to pass.

A wide experience covering a number of years with lines constructed as outlined above seems to indicate that the clearance space should be not less than 40 inches vertically between signal wires and attachments and electric light or trolley-feed wires and attachments. Experience also shows that a climbing space of not less than 30 inches wide on either the back or field side of the pole is necessary in order to provide for climbing and for the raising and lowering of transformers. It is, of course, preferable to provide a greater vertical separation than 40 inches between signal wires and wires carrying high voltages, and many companies endeavor to have this space not less than 6 ft., particularly with new lines, using the minimum clearance of 40 inches only on old lines that are made joint after the line has been in service for some length of time.

The street side of the poles should always be reserved for the vertical runs of the electric light or power wires, and the field side for the vertical runs of signal wires. Owing to the fact that there is no known protective device that can be placed on a signal circuit that will afford adequate protection against the potentials carried on high-tension circuits, it is not considered advisable to place telephone, fire-alarm or other signal circuits on the same poles with such circuits. High-tension lines should, wherever practicable, be constructed on rights-of-way remote from those occupied by the signal lines. (By high-tension circuits are meant the following: Constant-potential, alternating-current, neither side grounded, exceeding 5000 volts; constant-potential, alternating-current, one side or neutral grounded, exceeding 2900 volts to ground; constant-current, series-metallic, line current exceeding 7.5 amp., and constant-potential, direct-current circuits including feeders and trolley-contact wires, one side grounded, exceeding 750 volts to ground).

Pole lines located on the opposite side of a street or highway are not considered as conflicting, but the same precaution should be observed, when erecting separate lines of poles, regarding the relative levels of the wires of different classes. That is, electric light or power wires should be carried on a taller pole line. This will enable electric light service wires crossing the streets to be carried over the telephone wires, and telephone wires from the opposite side of the street to be carried under the electric light wires. This practice prevents the interlacing of the service wires, which is liable to be a serious problem in congested streets.



Relative positions of power, signal and trolley wires on joint poles.

In order to bring about the conditions outlined in the foregoing it is necessary to have some form of inter-company agreement covering not only specifications and methods of construction and the reservation of space requirements, but also a fair division of the construction and maintenance costs. In Connecticut the matter is helped along by fair-minded legislation, and the Public Utilities Commission of Connecticut has promulgated in its Order "D" docket, No. 1447, a set of rules and specifications under which most of the wire-using companies of the state have been operating for some time with very satisfactory results.

Since most of the lines in Connecticut have been placed

*Chairman of Committee on Joint Usage Rules, before International ...ciation of Municipal Electricians.

on a joint-use basis and the construction standardized there has been a marked decrease in the number of fatal accidents to the employees. This is undoubtedly due to the fact that employees working on signal circuits no longer have to climb through electric light wires in order to get at their own work, and the electric light wires are generally placed so far above the signal wires that electric light employees are not apt to come in contact with grounded conductors of another class while working on high-voltage wires.

There is another feature which appears to make joint use preferable, particularly in cities and towns where there is considerable local distribution; that is, that the city or town is more completely covered by the pole lines of the two companies, and many companies have reasoned that it is better to own one-half of all the poles in a locality rather than to own all of one-half the poles.

In order to insure the success of any joint-line arrangement, particularly where electric light and signal lines are to occupy the same poles, the broadest possible co-operation must be indulged in between the various occupants for eliminating inductive interference. Electric light lines should always be kept free from grounds that might upset the electrostatic balance to ground, also long single-phase taps from three-phase circuits should be avoided wherever practicable. The voltage wave developed by the generators should be as free as possible from noise-producing harmonics, and consideration should be given this fact before the generating machinery is purchased from the manufacturer. Deviation from the pure sine wave should not be allowed to exceed the limit set by the American Institute of Electrical Engineers. These precautions are quite necessary in connection with electric light or power circuits, because it is not always possible to transpose telephone lines, for instance, so as to eliminate all inductive interference. In many instances it has been found necessary to place transpositions in the electric light or power circuits to co-ordinate with those in the telephone circuits.

In Connecticut alone there are approximately 1,700 miles (2 700 km.) of pole lines used jointly by electric light and telephone or other signal lines. Practically all of this joint line mileage is standard as regards location of the wires and vertical or lateral separation, so that it is fair to say that the joint-use line is, under proper regulation, a success, simplifies the distribution problem and works toward safety.

While it is sometimes more expensive to erect a joint line, the cost to each occupant is usually less than a separate line or poles would be. The maintenance costs are also less because of this division of the charges. The lines appear to stand up better under the influence of severe storms because of the fact that such joint-use networks are usually much better guyed or braced than a single line would be. Moreover, such lines receive more attention from the engineers in order to make them satisfactory to all parties concerned.

Is the Zone System the Fare Solution?

By Thos. Conway, Jr.*

The electric railway industry stands face to face with the greatest crisis in its history, not even excepting the revolution which followed the electrification of the horse-car lines. The problems of the early 90's were technical and concerned the handling of a largely augmented business by a new and untried method of propulsion. The problems of to-day are financial and concern the method of saving an industry whose entire economic basis has been undermined.

In the early days of the war, when the prevailing opinion was that the struggle would be comparatively short-lived, the remedy for the electric railway situation seemed to be a temporary increase in fares which would carry the industry over the crisis. With slight advances in labor costs and the practical certainty of a marked reduction after the war in the prices of materials, it then seeemd possible to return speedily to substantially a pre-war basis. It was this situation which caused electric railway operators to move for a horizontal increase in fares to 6 cents, resulting in an increase in revenue of about ten per cent., sufficient to offset the then increased cost of operation. The 6-cent fare was easily understood by the public, and its adoption would destroy the popular belief that a nickel and a street car ride were synonoymous. Everyone felt that after the war was over it would be possible to fix the rate of fare with reference to the cost of service.

It is apparent that there is now no likelihood of a return to pre-war operating costs. The war hastened the process of readjustment to a higher cost level, which would have occurred over a period of years in any event.. Labor, which represents 60 per cent or more of the cost of operation of the average electric railway, has secured very large increases which must in the nature of things be more or less permanent. The solution, whatever it may be, should therefore not only carry the industry through the war, but furnish a sound economic basis for a period of years.

Turning to the Zone System

Up to the present time two alternatives have been seriously considered. The first involves a horizontal increase in the unit of fare to 7 cents or more, as the case may require. The experience thus far secured is fragmentary, but it is apparent that progressive reductions in travel. If a 6-cent fare increases revenue 10 per cent, a 7-cent fare will not increase revenue 20 per cent. Indeed a point is soon reached where a further increase in fare will bring about an actual decrease in revenue. Just where this point is will vary with each particular property, but it is safe to say that the practical limit of horizontal rate increases has been reached upon many properties.

It is this situation which has caused the thoughts of a large percentage of the industry to turn to some sort of a zone system as a possible solution. In substance, the fundamental idea of a zone system is that the rate of fare shall bear some relation to the length of ride. The application of this principle takes various forms. In Europe the passenger fare varies directly with the mileage traveled. In this country the practice has heretofore been to establish certain arbitrary zones. A person traveling in a zone pays a certain rate, and his fare increases with the number of zones through which he travels.

Manifest Advantages of Zone System

The appeal of a zone system is due to its manifest advantages. While higher horizontal rates inevitably cause a reduction in the volume of a utility's business, a properly devised zone system would hold a larger proportion of the existing travel. A 6, 7, or 8 cent fare discourages short-distance riding, which under proper operating conditions constitutes profitable business.

From the standpoint of the public the zone system has

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the great advantage of making the long rider pay a correspondingly higher fare than he who takes a short journey. The system appeals to the public, because a man pays for what he gets. It is true that the plan appears to saddle all of the extra costs upon a portion of the public rather than distribute the burden equally over the company's entire business. As long as the public regards increased costs as a temporary condition this argument has weight, but when it is understood that the increase will be in a large measure permanent, this contention loses force.

No Present American Zone System is Entirely Satisfactory

It has been my privilege to visit recently every city in the United States in which a zone system exists, to talk with the operating officials and to study the actual operation of each system. Judging from the standpoint of the financial results secured, I believe it can be said that no zone system now in force is entirely satisfactory. The Milwaukee zone system (in force upon the suburban lines alone) produced the revenue predicted at the time the original plan was formulated—a sum insufficient to meet present costs. In every other case the revenue producing possibilities of the system have been greatly over-estimated. In one of the most important of the recent experiments, the over-estimate amounted to as much as 40 per cent of the estimated operating revenue.

More Speedy and Safer Fare Collection Needed

The great difficulty with zone systems, as thus far employed, concerns the collection of fares. In general, two methods are employed. In either case city fares are collected in the ordinary manner, registration being effected with a fare box, overhead register or some other of the many fare collection devices now generally employed. In some cases, the fares on suburban lines are similarly collected and registered, the conductor going through the car and collecting the fares at each zone limit. Where outlying zones of one or two miles are used and the schedule is rapid, the conductor spends his entire time in successive trips through the car collecting fares. The practice is annoying to passengers and keeps the conductor off the rear platform, thereby increasing boarding and alighting accidents.

The alternative to this method is the even more cumbersome plan of using a duplex ticket. This method is employed on a number of systems, the plan being to collect the entire suburban fare as the car passes the limit of the central 5 or 6-cent area. Over-riding can be guarded against only through the use of hat checks, periodic inspections of the portion of the duplex given to the passenger or surrender of the duplex ticket as the passenger leaves the car. This method is so cumbersome that it is only practicable where there is no considerable amount of boarding and alighting at frequent intervals. It has proved impractical in city areas.

Its greatest defect concerns the possibilities of stealing on the part of conductors. Some idea of the extent of such losses can be secured from the experience of one of the most important companies which have tried a zone system. The news of the arrest of a number of conductors was followed by an increase of 10 per cent in passenger revenues, beginning on the succeeding day. No amount of inspection, however, appears to prevent the misappropriation of fares where travel is heavy and haste in collection is necessary.

The application of such collection methods to lines located wholly or in large part in the thickly built-up city territory is impossible. The Rhode Island Company and the Bay State Street Railway have recently decided to go from a system where rates of 2, 3, 5 or 6 cents per zone prevailed to a basis of either 5 or 10 cents per zone. A system with 5-cent zones is no different from that which has prevailed for many years in this country.

The only other method of fare collection thus far tried under strictly urban conditions is the plan employed in Pittsburgh. As the Pittsburgh Railways has pointed out, this is not a zone system but two flat-rate systems, one superimposed upon the other. The fare within a prescribed area, including the centre of the city, is 5 cents. Anyone travelling from the centre of the city to a point beyond the limits of this central area pays 7 cents, while the same rate of fare is charged for travel between any two points situated within this outside ring. From the standpoint of fare collections this system is simple. It, however, has the same disadvantages inherent in the high unit fare, because it discourages short riding in the outer zone in which a large proportion of the population is situated.

Better Method of Fare Collection.

After careful study, I am convinced that the successful application of a zone system in thickly built-up city areas is predicated upon the development of a more speedy and safer method of fare collection. The successful system of fare collection must be one in which the opportunity for the passenger to beat the conductor or for the conductor to misappropriate the fare is reduced to a minimum. Where fares of varying units are collected, it is out of the question to register them serially upon one register, even though a fare box or some other pre-payment device is employed.

One of the most prominent electric railway operators recently said to me that the industry would be saved if the men in it had brains enough to work out their own salvation. His conclusion is certainly true concerning the zone system. The problem of the moment, in so far as the zone system is concerned, is to devise a method of collection which will meet the practical conditions prevailing in all of our large cities. If a practical method of collection can be devised the zone system, in my opinion, furnishes the solution for companies whose average ride exceeds a mile in length. The possibilities of a zone system are now the subject of serious study and investigation by some of the largest companies in the country, and it is to be hoped that the solution will be shortly hit upon.

A zone system should encourage short riding. The long rider should be made to pay an adequate fare for the journey which he takes, and the cost of furnishing the service which he uses. Business should be encouraged rather than discouraged. The automobile, the improved highway and the jitney have taken enough of the business of the electric railway. More travel rather than less should be the goal.

Even with a satisfactory system of fare collection at hand I doubt whether it would be possible to work out a zone system of fares which would meet the financial necessities of many properties. I have recently seen a number of properties whose future seems hopeless. Sufficient travel can not be secured at rates of fare which will produce adequate revenues to defray the present high cost of operation. Indeed the extremity of the electric railroad industry is so great that every opportunity should be seized upon to convince the public that the function of the railway is to provide transportation rather than serve as a medium of reducing general tax bills.

Taxes at Expense of Public

In the days when the 5-cent fare ruled supreme, municipalities and states alike levied taxes and burdens of one kind or another upon the electric railway, upon the theory that whatever they got was at the expense of the utility owners rather than the car rider. To-day increased expenses must be immediately reflected in increased fares. There is no reason why the average car rider should pay higher

fares in order that streets be maintained for those who own motor trucks and pleasure automobiles. Franchise taxes levied upon the gross receipts of companies, payments for snow removal, street sprinkling and the like, will from this time forth require percetpible additions to the rate of fare.

It should be pointed out to the riding public that they are the ones who pay electric railway taxes, through higher fares. This is true whether a company operates under a sliding-scale fare, the "service at cost law" in Massachusetts or the strict control of a public utility commission as in most of our states. The utility's profits are in all cases limited to the amount necessary to induce capital to enter the business. When earnings exceed this amount rates are reduced, and when they fall below this requirement, rates should be immediately increased.

It is gradually beginning to dawn upon the people of this country that the days of profiteering in electric railways ended some years ago, and that if the electric railway is to survive it must be helped rather than hindered, and must be allowed to charge a rate of fare which it sufficient to maintain its solvency and to permit it to continue to serve the public. That the cost of the service, by whomsoever provided, must be met, goes without saying. The next few months will be the most critical in the history of the industry. Its entire future hangs in the balance. It can not long continue upon the present unsound economic basis.

Why the Railways Need Higher Fares*

I shall not attempt to review the events of the past year as they have affected this industry, nor shall I try to point a way out of the alarming situation in which we find ourselves. That is the province of this conference.

I do desire, however, to emphasize a point which I believe has not been so forcibly impressed upon the public from whom we are asking increased revenue as it might have been.

The leading economists of the country unite in the statement that the purchasing power of the dollar has declined at least 50 per cent. since the early nineties. In other words, the 50 cents of that period bought what it requires $1 for to-day. And this means to the street railways of the United States that the 5-cent fare of the nineties is now less than a 2½-cent fare.

In our request for a higher fare we are, therefore, asking nothing more than that what we receive for the service rendered shall be restored to somewhere near its real worth at the time when the rate of fare was fixed. The coin dropped in our fare boxes to-day bears as an impress "5 cents"; but as compared to the 5 cents which was stipulated in our franchises or fixed by statute as our lawful and legal fare, it is 2½ cents and no more. To put the street railway fare upon a parity with what was received in the decade 1890-1900, under a franchise, a statute, or an agreement, calling for the nickel unit, it would now be necessary to substitute the dime for the nickel.

The wages paid to the motorman in this earlier period were approximately 20 cents an hour. With a single fare we could therefore pay for fifteen minutes of his time. To-day, through the action of the federal government, the motorman's pay approximates 38 to 48 cents an hour, and a single fare pays for but eight or six minutes of his time according to the rate of wages, and this in varyingly increasing ration is true of all that we must use to render our service.

On the other hand, taking $2 a day as the average wage in the earlier period, the workman using the street car to ride to and from his work was compelled to pay out 5 per cent of his day's wages for transportation. To-day, with an average wage of $4, and this is probably much less than the correct figure, he pays for the same purpose but 2½ per cent.

This decreased purchasing power of the dollar is not a product of the war alone. The war but gave it an additional, although a mighty, impetus. It has been a gradual development and in other industries it has been accompanied by an increase in price of commodity, which has at least kept pace with and, in some cases, passed it.

It has been in part overcome in the electric railway field by extraordinary improvements in apparatus and methods, the result of millions spent in experiments due to the enterprise and initiative of railway men and manufacturers of which the public reaped the benefit.

The limit of economy made possible by these improvements in operation was, however, largely reached some time before the war, and for a number of years the difference between the cost of producing our service and the price at which it was sold has come from the pockets of those whose money is invested in the industry.

That was the situation when the war sent the price of everything which we must use in producing our product soaring skyward and left the price at which we sell stationary.

It is plainly evident that whether the public shall decide to operate the street railways, whether it assumes greater control over them, or whether it allows them to remain in the hands of private investors, that the unit of their fares, the price at which their product is sold, must be restored at least to the level which prevailed in past years.

I have confidence in the common sense and judgment of the public. I believe that it stands ready to pay a fair price for what it receives and I conceive it to be our main duty both as members of this association and as operators of electric railways to see that the public is informed as to what such a fair price really is, not in terms of coinage, but in those of value—that is purchasing power.

*From the address of President L. J. Stanley, before the recent New York Conference of the A.E.R.A.

New Book

The Decimal System—by Charles Hoare; Effingham Wilson, 54 Threadneedle Street, London, Eng., publishers; price one shilling. This book, which contains 85 pages, has been compiled with a view to the daily requirements of the artizan and mechanic rather than for the man with scientific training. It is intended that, with moderate practice and study, it should be possible for any one acquainted with the simple rules of arithmetic to obtain with ease and accuracy the result of calculations connected with their daily occupations and which they have hitherto been accustomed to consider as wholly beyond their reach. The author has borne in mind that the elementary principles of decimal arithmetic are practically unknown to a large number of workers and that by acquiring this knowledge in compact and understandable form they will be of much greater value to themselves and their employers.

Passenger traffic on the Toronto civic car lines for November shows increases of 219,974 in the number of persons carried and $3,233 in revenue over the same month last year.

A newspaper report states that the Italian Minister of Finance proposes, among other things, state control of the sale of electric lamps.

The Dealer and Contractor

The Next Ten Years will see the Average Farmer with an Electric Plant—Who Gets the Business, the Machine and Automobile Agent or the Electrical Contractor-dealer?

We have made a very thorough investigation of the prospective field for electric light and power plants for the farm home. We are now confident that within the next ten or twelve years at the most, it will be extremely difficult to find any farm home, except those occupied by renters, which will not be equipped with an electric light and power plant of some kind.

I am convinced that the farm-lighting plant market is going to develop much faster than did the automobile market. The reason for this is apparent. Ten or twelve years ago, when the automobile manufacturer first began to build up a dealer's organization in small rural trading centers through which to develop the farm market for automobiles, there were at that time probably not more than one or two farmers out of each ten who had available cash. Furthermore, at that time, the farmer had to be convinced that the gasoline machine was a practical machine for him. Up to that time, he had not come into close contact with the improved living conditions in the cities where the inhabitants had access to all the comforts and conveniences which belong to the city home.

To-day there is probably not one farmer out of ten, excepting renters, who cannot afford to invest $600 or $700 for a complete electric light and power plant and its equipment for his home.

The automobile has largely done the missionary work for the farm-lighting plant. The automobile has educated and thoroughly convinced the farmer that the gasoline engine is a practical equipment for him. Almost every farmer owns an automobile, a great many of them a truck or tractor or probably one or more stationary engines for grinding feed, sawing wood, pumping water, churning, washing and other purposes. Many other educational influences have recently been at work for the farmer.

No doubt when you hear that $30,000,000 worth of electrical equipment was sold the farmers last year and $60,000,000 this year, you probably wonder who has sold them this equipment. I can assure you it is not the mail order houses, for electrical equipment is entirely too mysterious a proposition for a farmer to buy from a mail order house. Some little of it has been sold by the farm implement dealer, but very little, as he knows little about it and as a rule lacks the necessary sales ability to sell the farmer lighting plants.

Who Should Sell Farm-Lighting Plants?

Who is the logical man to sell farm-lighting plants? I will let electrical dealers answer this for themselves when they have reviewed the facts. Isn't it true that farmers of to-day know more about gasoline engines than any other class of merchants, not excluding even the automobile salesman? It will not take him long to find out and tell you whether or not your gas engine is right. Who besides the electrical dealer is sufficiently versed in electricity to know whether the electrical equipment is right for the farmer's needs? Who knows what the farmer can or cannot do with the plant or what he should do or should not do? Which is more important: To sell the farmer a very fine light plant and set it in his basement and run a few lights around so that he had to get up on a chair to turn them on and off, or to put in a light and a switch where he needs it and can reach it conveniently? Who can wire it with the proper size of wire so the farmer will not have a continual loss? Who understands how to wire for his washing machine, cream separator, pumps, vacuum cleaner and heater plugs so that he will not burn the contacts off his iron while pulling out the plug? Who can wire all his outbuildings so he can have lights when and where he needs

Farmer is Concerned with Results.

We have found in the installations we have made that the farmer knows and cares very little about the plants that make the light. The result is what he desires. Farmers tell us how fine it is to work in a nicely-lighted barn and outbuildings and how the big light out in the yard lights up the neighborhood, and how he turns on his cream separator and goes in and eats his supper. Then Mrs Farmer tells us the motor has taken all the work out of washing and she would not be without the electric iron for the price of the plant, and "those two lights on my dresser are the finest things. I never really saw myself in the glass at night until I got those. In fact, we are just so pleased with everything except that $15 fixture in the living room. It don't look good enough beside the two $50 fixtures in the parlor and dining room, and as we got off so much cheaper than we thought we would, Mr. So and So says I can have this changed." Mr. So and So speaks up and says, "Yes, we have lived on this one farm for fifty-five years, and the $1,050 we spent with you is the best improvement we ever put on the farm and there isn't money enough in your city to buy this back if we could not get another."

This customer is simply a good, substantial, progressive farmer who has worked and worked hard for all he has and spends his money wisely. His is only one example of all our installations, which we insist on being as complete as his. When these farmers express the great pleasure they get from the light, we attribute very little of it to the plant in the basement. However, we do insist on the plant being one we consider the best. But the farmer's great satisfaction, we think, comes from the complete and conveniently designed installation which we insist each must have. We surely think the barber, the plumber, or hardware man is going to have some job putting across one of his cheap installations in the vicinity of one of our plants.

The reason the electrical contractor and dealer has not sold these plants in the past is that he has failed to introduce

From a paper presented before the Illinois State Association of Electrical Contractors and Dealers.

salesmanship into his business. How many times he has sent to his prospective customer a price on something and closed the accompanying letters by saying, "I sincerely hope our price will be low so you can give us the business." If we had all the paper we wasted this way, it would be worth a lot of money now.

It always seemed to me that an electrical engineer felt that it would be below his dignity to try and sell his product like other merchants, although he is a merchant like anyone else. A few years ago, however, we accidently got hold of an engineer that must have beeen born a salesman, for he certainly didn't learn it around our office. He would not mail his proposals, but he would take them out and stay with the prospect till he came back with the job at the highest figure submitted. Then after he got the job, everything had to be done just right. He was a hard man for our men to work for at first, but he soon convinced them it was no harder to do things right than to do them otherwise. This man soon developed a clientele that did not care to go to the trouble of getting bids. They would simply leave it to him. He is now helping design the electrical equipment for the new boats of the United States Navy. Before he left he gave us a taste of what salesmanship would do for our business, and we have endeavored to progress on these lines, slowly but surely, since.

I am very sure the electrical contractor-dealer is the logical man to develop this farm-lighting market. But he must wake up if he would get the business and prevent automobile dealers from selling half-made jobs to the farmer. My advice to the electrical contractor-dealer is to get into the farm-lighting business at once. It is a good war-time business and will be a better business after the war. Moreover, it will enlarge the field of the contractor-dealer. Your sales organization can be utilized for city sales at such times as they cannot get out into the country.

While our firm was not a pioneer in this business and we do not know that we have gone at the thing just right, I am willing to tell something of our experience. We first had a meeting and talked over the proposition of selling farm-lighting plants. It was a pretty cold meeting. There wasn't very much enthusiasm over it. About the only one in favor of it was myself, and as I couldn't see any other business in sight with a spy glass, and as I was general manager, I was able to put it over.

Finding the Plant and the Prospects.

We then started to choose a plant to sell. We considered the merits and demerits of them all and finally picked on one we thought was the best. We ordered one of these on a three months' trial, and gave it a thorough practical test. After this test we became thoroughly sold on this machine. It may be possible that the manufacturer of this plant had better salesmen than the others, but as we in our own minds feel that we are selling the best, we believe that is all that is necessary.

We next fitted up a demonstration room in our basement. It was done in mahogany woodwork and furniture. It had rugs on the floor and was just as nice a room as you would see anywhere. We installed the plant in running order, connected up the batteries, hung fixtures, connected up an automatic water system, electric washing machine, vacuum cleaner, toaster, iron and cream separator. In fact, we have every device there that can be bought for 32-volt circuits.

We then got a Prairie Farmers' directory giving names of all the farmers in our territory. These were card indexed. All the farm owners, large tenants and other prospects were placed in a mailing file. We mailed a personal letter explaining our entrance into this field. We followed this up in a week by a circular of the plant with a return postcard. We received two cards back out of 3,500. This convinced us the farmer will not admit to anyone that he wants to buy anything. He is afraid you might sell him. We followed this with a catalogue of the plant. This we followed with a descriptive flyer of the plant and different accessories he could use with the plant and cuts of a few lighting fixtures.

By this time we had a plant installed. We photographed the farmer's home, got a testimonial from him and had this all printed on a flyer with a little selling talk and mailed these to each of our list. We get out one of these flyers each month.

How Many Trips It Takes To Sell a Farmer.

In the meantime, we had started out our salesmen to call on the farmers, to get acquainted with them, to learn to talk about the crops. In this we learned to always bear in mind that you can't sell a farmer the first trip, seldom on the second trip, rarely on the third, sometimes on the fourth, maybe on the fifth, possibly on the sixth, more probably on the seventh, but more likely on the eighth. Still your chances for making the sale are better on the ninth trip, but the tenth seems to be the good average number.

The hardest proposition of all is to get a salesman that can sell a farmer. A good city salesman rarely has the patience to sell the farmer. To sell the farmer, a salesman must first of all know his product through and through. He must be absolutely honest. While an untruthful salesman will not get very far any place, he absolutely cannot sell the farmer a lighting plant. To make a sale of a plant to the farmer, the salesman must get his confidence, must keep it after the sale while the wiremen are making the installation. Even after the job is completed it is good practice to have the service man call on the farmer once a month and see how things are going. Show him that you are still interested in his plant after you have his money.

We have found that such service men are less expensive to have than salesmen. If the service men's work is well done, the farmer, who is your customer, will do your selling for you in his neighborhood.

Toronto Illuminating Engineers Meet

The monthly meeting of Toronto illuminating engineers was held in the MacLean Building at 347 Adelaide St., West, on Friday, Dec. 3. Lieut. Oliver gave an address on artificial daylight, and explained the properties of a special form of daylight glass, his own invention, outlining the legion uses to which such glassware is being put. A number of curves, prepared by Lieut. Oliver, showed that the spectral intensity through the special glass demonstrated, coincided very closely with that of northern daylight, being somewhat low at the violet end and high at the red end of the spectrum. This, however, the speaker explained, was for sentimental reasons, the excess of red appealing more strongly to the average customer. If required, the process of manufacturing could easily be varied to duplicate, exactly, the natural daylight spectrum.

Lieut. Oliver made the suggestion that inasmuch as it is the public who offend most in the matter of bad lighting, and since it is the electrical contractor-dealer who is more closely in touch with the public, the meetings of illuminating engineers should be attended both by the contractor-dealer and the public. This is undoubtedly a suggestion in the right direction, and we hope something may be done before the present season is over to bring about some joint meetings.

The Ontario Association of Electrical Contractors and Dealers, Toronto District, held an important general meeting in Room G, King Edward Hotel, on Thursday evening, Dec. 12.

The Relation of Light to Health*

By Charles E. De M. Sajous, M.D., Sc. D.

The word "ferment" is steadily being replaced in medical phraseology by the word "enzyme." In the words of Professor Mendel, "Enzymes are no longer thought of exclusively as agents of the digestive apparatus; they enter everywhere into the manifold activities of cells in almost every feature of matabolism." In other words, the same ferments, pepsin, trypsin and others which first prepare foodstuffs in the stomach and intestine, for assimilation by the tissues of the body at large, are the same agents which carry on certain functions in the intimacy of the tissues.

Considerable evidence is available to show that these digestive ferments are carried from the ailmentary canal to the tissue cells by certain white corpuscles of the blood, in which they are readily found. To these white corpuscles belong the phagocytes, which ingest and digest disease germs. We thus have digestive ferments taking part—along with the oxidizing ferment—not only in the vital processes of each tissue cell, but also the defense of the body against disease.

Prevost's theory of mobile temperature equilibrium is now known to apply to radiant heat as well as to heat energy derived from other sources. It is simply that if two bodies of different temperatures are placed close to each other, the warmest of the two will lose by emitting radiant heat which the colder body will take up until the temperature of both is equalized. Briefly, the skin absorbs radiant heat when the cutaneous temperature is lower than that of the radiations received, up to certain limits (influenced by the perspiration and other factors) and the temperature of the tissues of, and beneath, the skin is thus raised.

The penetration of radiant light through the tissues when long wave lengths characterize the rays, is considerable, that of red rays for instance, exceeding one inch. Careful experiments by Rollier showed that solar rays could penetrate the hand and forearm and also, under favorable circumstances, the entire chest.

How does light energy influence the vital process of those tissues and contribue to the defense of the body against disease? Charcot, the French neurologist, as far back as 1859, urged that we should distinguish between the purely chemical effects and those produced by heat. In the present connection we probably are dealing with a process in which the chemico-physical effects credited to oxidizing ferment I have termed "adrenoxidase" and heat both take part, particularly near the surface.

There exists immediately under the superficial tissue a great system of small interwoven canals which, so to say, act as sewers of the tissue cells. They serve not only to carry off, but also to purify the fluids received from those cells by breaking down, as far as possible, the wastes and detritus that they form while carrying on the process which constitutes their life. These channels are interspersed with glands that contain phagocytes, i. e., cells of the type that destroy, by means of their digestive ferments, disease germs and other harmful substances that the small canals carry to them from every direction. This system of lympy channels and glands, known as the lymphatic system, is a prominent weapon of defense. Everyone has seen lymph, a whitish viscid fluid, collect on abrasions, and also enlarged glands on the neck of children. These latter are enlarged lymphatic glands trying to destroy bacteria from some source, the tonsils, adenoids, etc., thus preventing general infection.

The beneficial influence of sunlight is readily accounted for when we take the lymphatic system into consideration in addition to the tissue cells, in view of the effect of light energy as manifested by its radiated heat. Indeed,—and this is the dominating factor in the process—the ferments of both kinds previously referred to those which promote tissue oxidation and those that digest and destroy bacteria and organic poisons become, increasingly active as the heat to which they are exposed is increased, and we obtain as results an increase of both vital activity and defensive aggressiveness.

This increased efficiency of ferments under the influence of increased temperature is the method adopted by Nature, according to my own viewpoint. It explains the process we term "fever," long deemed an enemy, but in reality a defensive function calculated to destrop poisonous substances or germs that have found their way into the body fluids and cells from a focus somewhere either in the superficial or deep tissues. In the course of fever, the germ destroyers, or phagocytes, are not alone at work in the blood stream, but the whole internal lining of the bloodvessels themselves is made up of these germ destroying cells. Again, the lymphatic vessels which act as drains for the tissue cells, we have seen, afford additional aid in the defensive process by means of the multitude of phagocyte-laden glands through which the serum obtained from the blood by the tissue cells must pass before it is returned to the circulation.

Of course, abnormally high fever, i. e., fever above 104 degrees F., for instance, may become dangerous in the sense that the very digestive ferments which have their purpose to defend, become too active and begin to digest not only the red blood corpuscles, a process physicians term "hemolysis," but also certain tissues, a process known as "autolysis." To offset these morbid effects of excessive radiation during hot weather, the skin protects the body by perspiring; the water which moistens the skin, by evaporating, keeps the surface temperature within normal limits. The cool baths physicians employ in the treatment of typhoid fever, have the same end in view; they keep the fever within safe limits.

On the whole, the relation of light to health may be summarized, in view of the few data submitted, by the statement that it is intimately bound up with the perpetuation of life, whether the tissues be normal or diseased. It tends to sustain health by promoting, as radiant energy, the activity of the oxidizing ferment adrenoxidase, which sustains the oxidation of tissue cells, an essential function of their life. It tends to defend the cell, when endangered by certain germs and poisons by enhancing through the heat energy developed, the efficiency of the defensive ferments which submit these harmful agencies to digestive destruction.

* A paper presented before the Philadelphia Section of the Illuminating Engineering Society.

Illumination in Stores and Factories*

By Frederick J. Pearson

An absolutely uniform lighting system in an establishment is inferior to a fairly uniform general lighting system supplanted by special lighting where necessary. Artificial lighting is used only for a small portion of the 24 hours and should be intensified to stimulate production. Efficiency, while important, should not always receive consideration to the exclusion of other factors which may result in greater satisfaction, increased sales in a store, etc. Reproduction of a lighting system merely because it was found to be satisfactory elsewhere, without considering the local conditions, may lead into error. Local conditions must govern design. In a store, a uniform general lighting system for all departments should be used as far as practicable in order to simplify maintenance. As few large units as practicable should be

*From a paper presented before the Chicago Section of the Illuminating Engineering Society.

used in order to reduce the initial and operating costs. The fixtures should be of simple outline and in harmony with the surroundings. Fairly dense diffusing globes with gas filled tungsten lamps are desirable. Show case lighting is rather unsatisfactory because of the poor service from the special lamps used. It is, however, necessary to light show cases locally. Show window lighting still suffers to some extent from exposed lamps.

Light conditions in most factories are poor. Good lighting increases production just as it increases sales in a store. Increases of illumination intensity from 6 to 10 foot-candles have increased the cost of lighting by only 1 per cent. and have been found to promote sales by 6 or 7 per cent. **Increase of lighting cost of 2 per cent. in one installation was reflected in an increased factory production of 10 per cent.** In fact improved lighting is one of the greatest of dividend producers whether in the factory, the store or the office. We are still far below the saturation point in artificial lighting.

In discussion, Prof. E. H. Freeman pointed out that the real measure of illumination effectiveness is the ratio between results secured and cost. In factories it is the relation of production to cost of lighting; in stores it is the relation of sales to cost of lighting.

Mr. J. R. Cravath questioned if local show case lighting is necessary.

Mr. O. L. Johnson referred to the difficulty in getting store and factory managers to appreciate the importance of good lighting which can be obtained only by the use of good equipment, well installed, with due respect to the local conditions. He inquired concerning the practice in department store lighting of adapting the lighting to changes among departments, and asked as to the effect of different lighting intensities on different departments from one to another of which shoppers might go.

Answering questions, Mr. Pearson made the following statements:

Show case lighting, although troublesome, is a necessity, because goods in cases cannot be lighted properly from a general illumination system. Merchandise sells better under light of higher intensity. In factories the choice of enclosing globes or reflectors must depend upon local conditions. Both are used in particular cases with success. It has been observed that intensified lighting results in greater activity, more enthusiasm and better sales service. Under daylighting there are on bright days fewer accidents, fewer discharged people, less dissatisfaction among employees. There is also a larger production in the factory and better workmanship. The difference between bright days and dark, cloudy days is really surprisingly large. In artificial lighting, with 7, or 8, or even 9 foot-candles, where formerly 6 were employed, better results have been obtained. Since increasing the illumination intensities employees and customers have both shown more enthusiasm, interest and activity. In the factory 6 or 7 foot-candles of general illumination is used, supplemented by local lighting. In dye houses and bleacheries, 12 to 15 foot-candles is the intensity adopted.

Can't We Run Our Own Business?

It is pretty generally admitted that there will be an enormous increase in Canada's electrical business. Huge projects that were in preparation when the war cut them short will, it is expected, be gone on with, with the result that in the country districts power will be available. This will mean that THE HARDWARE MEN, WHO HAVE BEEN LEADERS IN DISTRIBUTING ELECTRICAL SPECIALTIES of all kinds, will have a greatly enlarged field of operations.—Extract from a Canadian hardware journal.

Increasing Canada's Exports

The importance of universal expansion in production is admitted on all sides to be, now, more than ever, a national necessity and it is therefore always a pleasure to refer in these columns to instances where Canadian manufacturers not only rise to opportunities offering at the time, but have the forethought to prepare for them beforehand. One of our Montreal manufacturers, the Duncan Electrical Co., Limited, following up their active and successful work in the export field during the last three years, have decided to take one complete exhibition booth at the Lyons Fair, 1919, with a view to taking the fullest advantage of the possibilities offering—we understand that they were the first Canadian factory to apply for space there and we are sure our readers join us in wishing this company the best of results as a reward for their enterprise. A cordial welcome is extended to any Canadians visiting the Duncan Exhibit at the Lyons Fair.

Not Enough Electricity for General Heating

An interesting bulletin (No. 6) has just been issued by the National Advisory Council for Scientific and Industrial Research, entitled "The Heating of Houses—Coal and Electricity Compared." The article is by Mr. A. S. L. Barnes, assistant engineer Hydro-electric Power Commission of Ontario, with the co-operation of the technical staff of the Commission. The bulletin once again points out the futility of any hope that our water powers will ever supply sufficient energy for general heating. On the contrary, the use to which such powers will naturally be put is to operate industrial machinery and thus release large quanties of coal which, in turn, can be used for purely heating purposes. Mr. Barnes calculates that a city the size of Toronto would require a maximum demand of 1,000,000 h.p. As this is approximately twice the amount now being developed at Niagara Falls the hopelessness of general electric heating from our waterpowers is quickly understood.

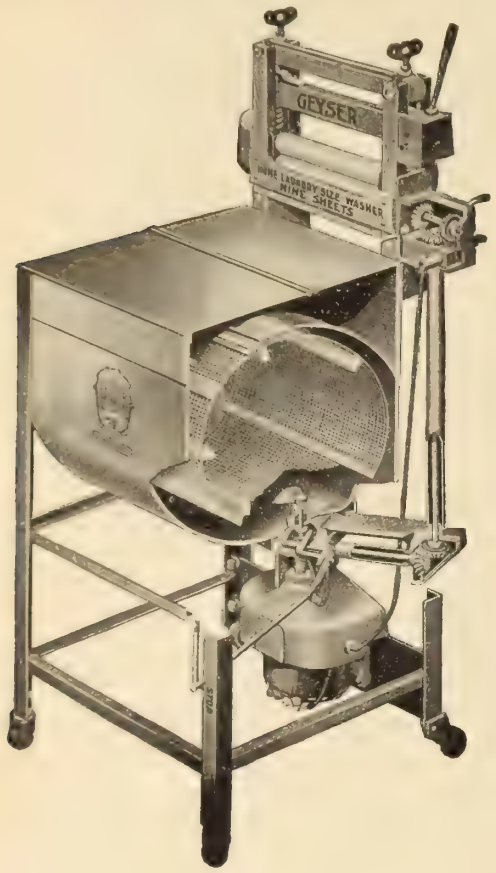
Electrical Goods Splendid Xmas Sellers

Hardwaremen in Next Two Weeks Have the Best Opportunity They Have Had in Four Years—Buying Public Feels Free to Make Larger Purchases Now War is Over—Don't Forget Attractive Window Display

This is the prominent heading of an article in a Canadian hardware journal. What do you think about it, Mr. Contractor-Dealer? Isn't this YOUR business AND YOUR PROFITS? Are you going to let him get away with it?

Geyser Electric Washers

The illustration herewith is a sectional view of the Geyser Electric Washer, manufactured by the Onward Manufacturing Company, of Kitchener, Ont. The hot suds are forced through the clothes by means of a high speed propeller in the bottom of the tank. The clothes are always under water in a constantly revolving cylinder. Geyser washers are made in seven sizes and are equipped with a swinging wringer, which



can be used in three different positions. All moving parts are enclosed and the tank and frame are electrically welded. The finish is baked enamel—white with gray trimming. The inside of the tank is specially plated, rust-proof and easy to keep clean.

A B.C. Get-Together Supper-Concert

The British Columbia Association of Electrical Contractors and Dealers held a "get-together supper-concert" at the Vancouver Citizens' Club, Vancouver Block, Vancouver, on Thursday, December 12, at 6.45 p.m. Invitations were sent to all electrical men, including manufacturers, central station men, jobbers, salesmen, office staffs, etc. The programme consisted of songs, speeches, choruses. Among the speakers being the following, Geo. Kidd, General Manager B. C. Electric Railway Co.; G. D. Neill, manager, Employers' Association. Subject: "Playing the Game." F. B. Milligan, credit manager, Northern Electric Company. Subject: "Electric Accounting."

Tickets at $1.25 each were distributed by the secretary, Captain W. J. Conway, 406 Yorkshire Building, and a number of representative elecrical men of Vancouver and vicinity.

Hubbell Specialties—The Harvey Hubbell Company of Canada are distributing a folder formally announcing that their Toronto factory is now completely equipped for the manufacture of Hubbell electric specialties, and that they are prepared to make immediate delivery to distributors and retail dealers throughout the Dominion.

The Hotpoint Company Fined for Breaking Rules and Regulations of Hydro Commission

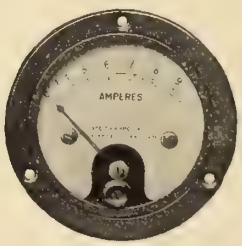
A summons was recently issued against the Hotpoint Co., according to a Kitchener paper, at the instigation of the Inspection Department of the Hydro-Electric Power Commission of Ontario, for having caused to be distributed advertising matter calculated to increased the fire hazard by advocating the use of electric heaters on key sockets, which is contrary to the Rules and Regulations of the Commission.

This is the first case of the kind for which a summons has been issued under the new regulations. Electrical inspection departments all over the continent have had to cope with this same evil and in order to sell heaters the vendors have resorted to a method of wrongly educating the public to the idea that no wiring is necessary.

In spite of warnings of the Inspection Department, the Hotpoint Company failed to comply with the instructions and a fine of $10.00 and costs was imposed by Magistrate Weir.

Meters for Wireless and High Frequency Work

A high grade hot wire measuring instrument designed particularly for wireless and other high frequency work, depending for its operation upon the expansion of a metal strip which is heated by the current to be measured has been developed by the Westinghouse Electric & Manufacturing Co. The slight sag in this conducting strip is magnified several hundred times on the scale by means of wires and a deflecting spring. The conducting strip is made of non-corrosive material. The separating posts have the same temperature coefficient of expansion as the conducting strip, so that the changes in room temperature do not cause an error in the reading of the instrument. The instruments are furnished in two forms, for flush mounting and portable. Similar instruments for switchboard mounting are also sup-





plied. The flush-mounting form, known as type EH, is of the round open-face type. The face is 3 inches in diameter, and the diameter outside the flange is 3¾ inches. It has a black rubberoid case and rim, with white dial. The portable form known as type PH, is mounted on a morocco-leather covered wooden case with heavy glass over the dial. The case is 3¾ inches by 4⅜ inches by 2 inches thick. The scale plate is made of metal, and the scale subtends an arc of 90 degrees, being 2⅜ inches long. The type EH meters have a guaranteed accuracy of 2 per cent. while the type PH, with hand marked scale, can be expected to show an accuracy within 1 per cent. of full scale. Standard meters are for 1, 2, and 5 amperes. Care must be used not to subject the instrument to more than 200 per cent. load.

At a recent meeting of the Ottawa City Council it was agreed to present the street railway purchase question to the electors in the form of three separate by-laws, the first dealing with the purchase of the railway at the expiration of the franchise in 1923, the second with the purchase of the railway at an earlier date by arbitration, and the third with the management of the railway.

POWER CABLE



350,000 C.M. 3-Conductor 12000 volt
Paper Insulated, Steel Tape Armoured Cable
Overall Diameter—3.62 ins.

Built to Specifications of Hydro-Electric Power Commission of Ontario

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Eugene F. Phillips Electrical Works, Limited
MONTREAL

Branches: Toronto, Winnipeg, Regina, Calgary Vancouver

Personal

Major T. W. Wilson, of Montreal, formerly on the engineering staff of the Montreal Light, Heat & Power Co., has been decorated with the D.S.O. About a year ago he was awarded the M.C. for conspicuous work at Passchendaele. He has been three years overseas.

Mr. W. D. Neil, Superintendent of the Eastern Division of the C. P. R. telegraphs, has been transferred to the Ontario division, being succeeded by Mr. C. L. Leighty. Mr. W. M. Thompson, Traffic Superintendent of Eastern lines, is promoted to Superintendent of the Eastern Division.

Mr. W. E. Bell, Montreal, has been appointed Acting Division Superintendent of Telegraphs of the Grand Trunk Lines in Alberta and British Columbia. Mr. Bell, whose headquarters are at Edmonton, has jurisdiction over all matters pertaining to the construction and maintenance of telegraph and telephone lines and operation of railroad and commercial telegraphs in the two western provinces. He succeeds Mr. W. J. Rooney, who has been granted leave of absence owing to ill-health.

Obituary

Mr. James T. Mattice, commercial superintendent of the Manitoba Government telephones, died in Winnipeg on November 7. He was for many years on the staff of the Bell Telephone Company in Montreal; in 1906 he removed to Winnipeg, and was the company's contract agent in 1906, when the Manitoba Government took over the telephones.

Mr. Thos. Howe, local manager of the Bell Telephone Company at Tilbury, Ont., died recently.

Mr. G. B. Dowswell, president of Dowswell Lees & Company, Limited, manufacturers of electric washing machines, Hamilton, Ont., died recently.

Current Notes

Fort William, Ont.

The city council of Fort William, Ont., have passed a by-law authorizing an increase in fares on the street railway, subject to approval by the Ontario Railway Board. Under the new arrangement there will be only one rate—straight five cents—for all adults between 5.30 a.m. and midnight, and ten cents straight after midnight. Children's tickets will be eight for a quarter. The new rates will go into effect on New Year's Day.

Montreal, Que.

The Montreal office and warehouse of the Canada Wire and Cable Company, Limited, and of the Moloney Electric Co., of Canada, Limited, have been removed to 143 Beaver Hall Hill.

The statement of the Montreal Light, Heat and Power Consolidated for the fiscal half-year ended October shows gains in gross and net revenue and in surplus. The gross stands at $5,297,130, an increase of $474,420 oer the 1917 period; operating charges were $328,642 higher at $2,539,339; net revenue was $145,779 higher at $2,757,791, and surplus better by $145,199 at $2,225,884. During October the gross increase was $64,890; the net $32,391, and the surplus $29,880. The total of the latter item was $444,238, the largest in the history of the company.



Mr. Contractor-Dealer—Is this one of YOUR customers?

Regina, Sask.

The high cost of labor and material is being felt by the Saskatchewan government telephone system and it is announced that rate increases will be necessary in the near future.

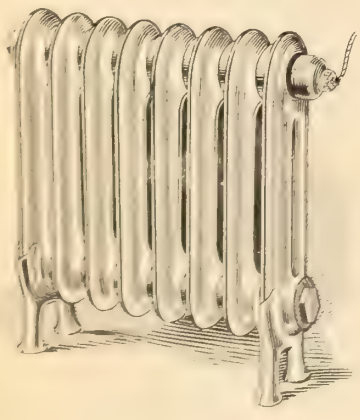
Toronto, Ont.

At a recent meeting of the executive of the Hydro-electric Railway Commission a resolution was passed and will be forwarded to the Dominion Government recommending that the Government purchase the Grand Trunk Railway and that the Hydro build electric lines from Toronto to Buffalo, and Toronto to London, the cost of the proposal being in the neighborhood of $25,000,000.

Toronto Street Railway receipts for November were $20,279 less than the same month last year. This, however, is attributed to the loss of revenue on the two days when people were celebrating the signing of the armistice and the street cars were tied up. Every previous month this year has shown an increase in gross receipts and in the city's percentage. Last month's receipts were $547,226, as compared with $537,505 in November, 1917. The city's percentage was $53,010, as compared with $55,823, a decrease of $2,843.

Winnipeg, Man.

Application has been made to the public utilities commission for an increase of from 15 to 20 per cent. in the fares on the lines operated by the Winnipeg, Selkirk and Lake Winnipeg Railway Company. It was stated that the company is at present facing a yearly deficit of $52,000 and that the suggested increase in fares would still leave a deficit of $20,000.



THE

Salisbury Electric Radiator

Real Radiation from Electrical Energy
A Fool-proof Electric Radiator
No Water—No Repairs
Nothing to Re-fill

This is your opportunity We have a good proposition for you.

SALISBURY ELECTRIC COMPANY, LIMITED, TORONTO

GET THE GENUINE

Look for the Name

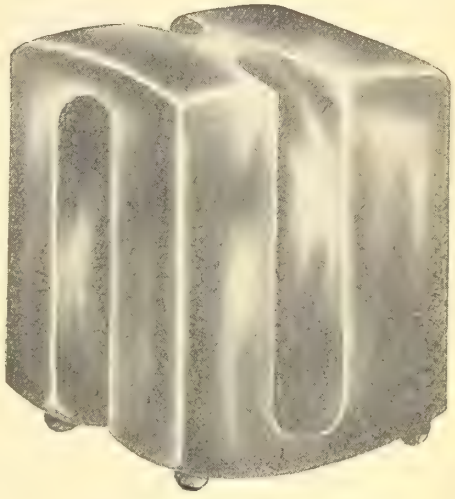
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You want strain insulators that are strong physically, that stand up under the exceptional conditions of the heavy storm; that hold up under a load of sleet; that don't crack when the thunder rolls, the lightning flashes, and the wind whistles.

This is the kind of strains T. C. White Company is making of porcelain in a variety of sizes for different loads, and several designs for varying conditions.

It will pay you to write for bulletin which shows designs and gives the complete data on strain and electrical tests.

Write today.



Type No. 600

T. C. White Electrical Supply Co., 1122 Pine Street, ST. LOUIS, M

Trade GEYSER ELECTRIC WASHER Mark

THE WORLD'S MOST EFFICIENT WASHERS

GEYSER Electric Washer

Simple Safe Silent

(Made in three sizes)



A most desirable asset to home conveniences and a most satisfactory machine to install. The Geyser Electric Washer will last a lifetime and live up to every claim we make for it in efficiency. No other line of washers has met with the success of the Geyser, either in ready acceptance or in its all round utility.

It has many improvements you would be interested in. Reversible wringer, etc. Why not write us for further particulars today? Our discounts are liberal.

Onward Manufacturing Co.

KITCHENER, ONTARIO

Motor For Sale

[illegible] for immediate delivery one [illegible] 3 phase, 60 cycle, 550 or 2200 [illegible] R.P.M. Westinghouse type M.S., mill [illegible] motor, complete with [illegible] switch. This motor is [illegible] connection, but also equipped with special wooden pulleys for belt drive. The motor has been entirely rewound and is as good [illegible] For further particulars write or wire [illegible] Engineering Corporation, 202 C. P. R. Bldg., Toronto, or, Room 10, Windsor [illegible] Montreal. 24

Motors For Sale or Exchange

We [illegible] following 60 cycle, 3 phase, 220 [illegible] for sale or exchange for 25 cycle mo[illegible] as follows:

1 40 H.P. Crocker-Wheeler, 1200 R.P.M.
1 35 H.P. Westinghouse 1200 R.P.M.
1 25 H.P. Crocker Wheeler 1200 R.P.M.
1 15 H.P. Fairbanks-Morse 1180 R.P.M.

The Windsor Sand and Gravel Co., Ltd.,
24-1 Walkerville, Ont.

POSITIONS VACANT

ELECTRICAL CONSTRUCTION MAN, elec[illegible] installations. Also one electric motor repair man. Scott Bros. Electrical Co., Windsor. 24-1

Open Evenings by Appointment

A California dealer, writing in Electrical Merchandising, offers a solution to the difficulty of providing for evening shoppers without the attendant necessity of keeping open every evening. Some months ago, he says, we discovered that a good many people who are busy during the day have not the opportunity to call at our salesrooms during the hours they are ordinarily open, so we looked about for some way to make it possible to reach this class of trade. As it did not appear desirable to keep the showroom open every evening of the week we have adopted the plan of opening the showroom "evenings by appointment." Therefore we had a rubber stamp made and all of the solicitors' cards and certain of the pieces of literature sent out to customers now appear stamped with the following notice:

Sales Department Open Evenings
By Appointment
After 5.30 p.m. Telephone S.R. 725.

In order to make an evening appointment, it is now only necessary for the "prospect" to call one of the salesmen on the telephone, giving the hour and date he wishes to visit the salesroom and he can be assured that a representative of the company will be on hand to answer his questions and demonstrate any device in which he is interested.

How a Vacuum Sweeper Made a Furnace Draw

A vacuum cleaner salesman was recently demonstrating a cleaner and set of attachments at a prospect's home where it was extraordinarily chilly. The lady explained it by telling him that she had been unable to get the proper kind of coal and couldn't get her fire going very good. The salesman quickly suggested that her trouble could be readily solved with the vacuum sweeper and showed exactly how. He put on the blower attachments and held the hose close to the grate and in a few minutes the furnace was approaching red heat She bought the machine and attachments immediately and now uses this method whenever the furnace doesn't draw properly.

PETRIE'S LIST
of New and Used MOTORS
FOR IMMEDIATE DELIVERY

No.	H.P.	Phase	Cycle	Volts	Speed	Maker
1	100	3	25	550	480	Westg.
3	50	3	25	550	725	Westg.
1	30	2	60	220	1500	T. & H.
1	30	2	60	220	720	Fbks.-M.
1	25	2	60	220	945	Westg.
1	20	3	25	550	1440	J. & M.
2	20	3	25	550	710	Westg.
1	15	3	25	550	1500	C. G. E.
2	15	3	25	550	1400	Lancashire
3	15	3	25	550	730	Westg.
1	10	3	25	550	720	Westg.
1	7½	3	25	550	1500	Lang-Dav.
2	7½	3	25	550	725	Westg.
1	7½	3	25	550	750	C. G. E.
1	6	2	66	220	1200	T. & H.
3	5	3	25	550	1440	Excelsior
2	5	3	25	550	1400	Excelsior
2	5	3	25	550	720	Westg.
5	4	3	25	550	1400	Excelsior
2	3	3	25	550	1500	C. G. E.
2	3	3	25	550	1400	Excelsior
1	1	3	25	550	1400	Excelsior

Write Us for Prices

H. W. PETRIE, Limited
Front St. West - Toronto, Ont.

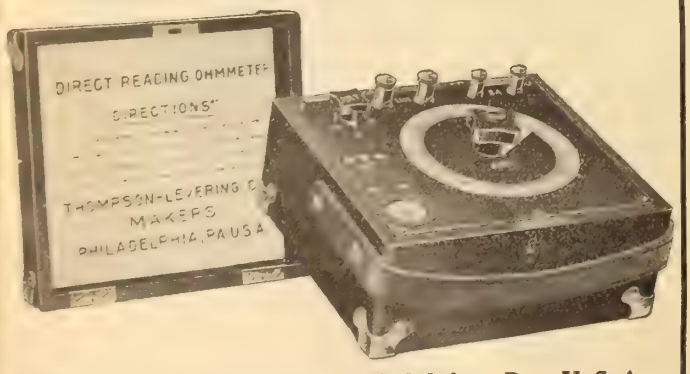
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Transformers
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Separate Published Stock Lists for above apparatus.

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NEW AND USED MACHINERY

A Continent-wide Service

List of Motors

No.	H.P.	Phase	Speed	Volts	Cycles	Starter	Make
1	15	3	1500	550	25	yes	T.H.E.
1	50	3	750	550	25	yes	C.G.E.
1	60	3	750	550	25	yes	Crocker Wheeler
2	50	3	750	220	25	yes	Lincoln
1	25	3	750	220	25	yes	Lincoln
1	25	3	750	220	25	yes	C.G.E.
1	10	3	1500	220	25	yes	T.H.E.
1	3	3	1500	220	25	yes	Westg. CCL.
1	½	1	1800	110	60	no	Fort Wayne
1	¼	1	1800	110	60	no	Westgh.
1	¼	1	1800	110	60	no	Fisher
1	40	2	900	220	60	yes	Fuller Wenstrom
1	15	2	1800	220	60	no	T.H.E.
2	5	2 or 3	1800		60	no	Westgh. CCL. rewd.
2	1	2 or 3	1800		60	no	Westgh. CCL. rewd.
1	½	2	1800	220	60	no	Westgh. CCL.
2	10	2 or 3	1200		60	no	Westgh. CCL. rewd.
1	5		1200	220	60	no	Union (New)
2	3	3	1800	220	60	no	C.G.E. rewound
4	7½	3	1800	220	60	yes	Lincoln

TRANSFORMER

1 40 K.W. Type R. 2200/220 Volts, Packard.

PLATER

1 Type C. Ostrander Seymour, 6 volt, speed 750, amp. 800.

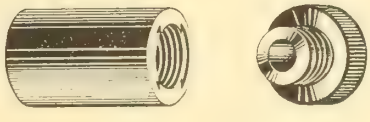
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Solderless Connection



Insulating Shell and Cap



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Patent Pending U. S.

DISCARD THAT BLOW TORCH

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If not place your orders early for

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If your local jobber does not handle our lines write direct

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Increase Light 500%

BY TEST



Illustration shows "Pittsburgh" Reflector No. 50 for 100 or 150 Watt Lamp. Dimensions: Height, 9½ inches, Width 10 inches. Holder 2¼ in. Form "O".

They are scientifically formed to obtain the maximum of light on the window trim. "Pittsburgh" Reflectors have attained extensive sales for window lighting, because of their saving of current and their dependability to increase lighting efficiency.

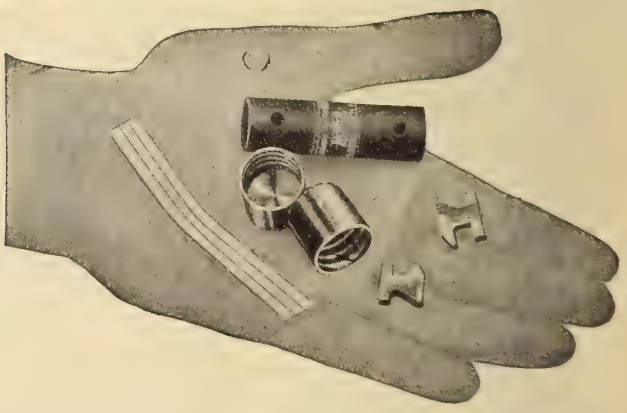
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Canadian Distributors

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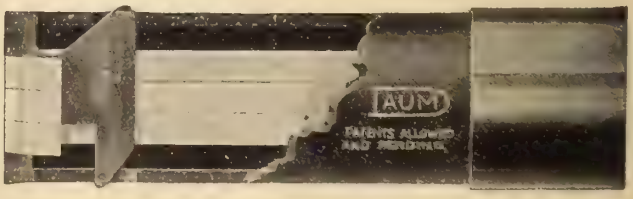
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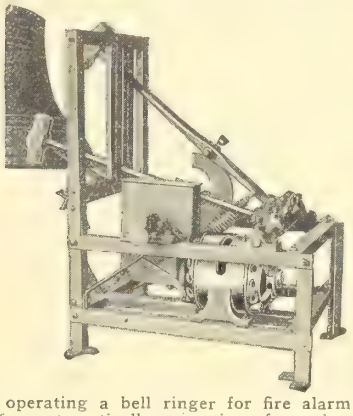
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½ h.p. motor operating a bell ringer for fire alarm service. This equipment is for automatically operating, formerly rung by hand.

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2	H. P.	550	V.	1700	R. P. M.	1
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15	H. P.	550	V.	1200	R. P. M.	2
30	H. P.	550	V.	900	R. P. M.	2
40	H. P.	550	V.	1200	R. P. M.	1
50	H. P.	550	V.	900	R. P. M.	2
75	H. P.	2200	V.	850	R. P. M.	1
125	H. P.	550	V.	690	R. P. M.	1
150	H. P.	550	V.	600	R. P. M.	1
200	H. P.	2200	V.	514	R. P. M.	2
400	H. P.	2200	V.	160	R. P. M.	1

Transformers, Pole Type 2200 - $\frac{220}{110}$ Volts

3/4	K.W. 11	2¼	K.W. 19
1	K.W. 15	3	K.W. 12
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2	K.W. 24	5	K.W. 55

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Splendid Action

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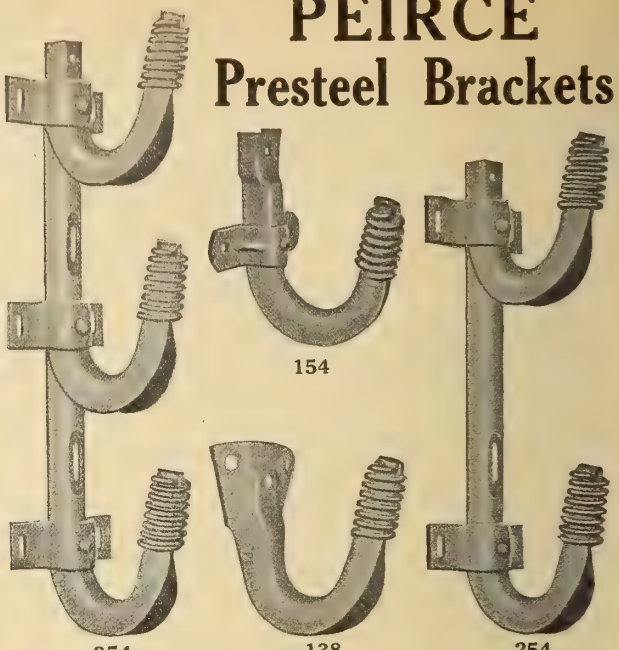
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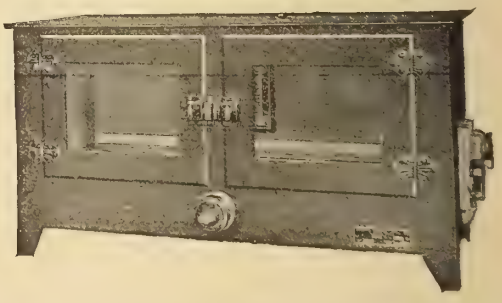
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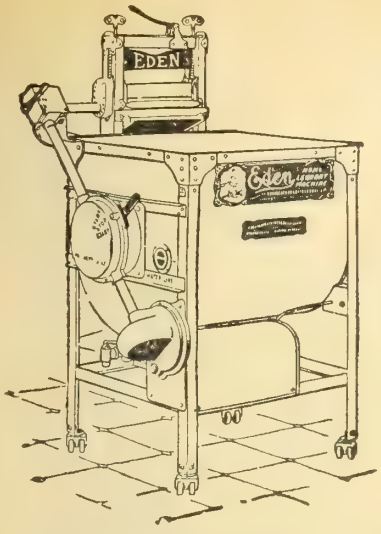
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Good Profits—Easy Sales

are assured for the dealer who handles the Eden Washing Machine. A first grade machine, that once sold, stays sold and brings new customers.

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"The workmen have formed the habit of using Dossert Connectors for all kinds of connections and consider it a hardship if they are called upon to perform the tedious and laborious task of making a soldered joint with its attendant acid fumes, gasoline torch smoke and burned fingers."

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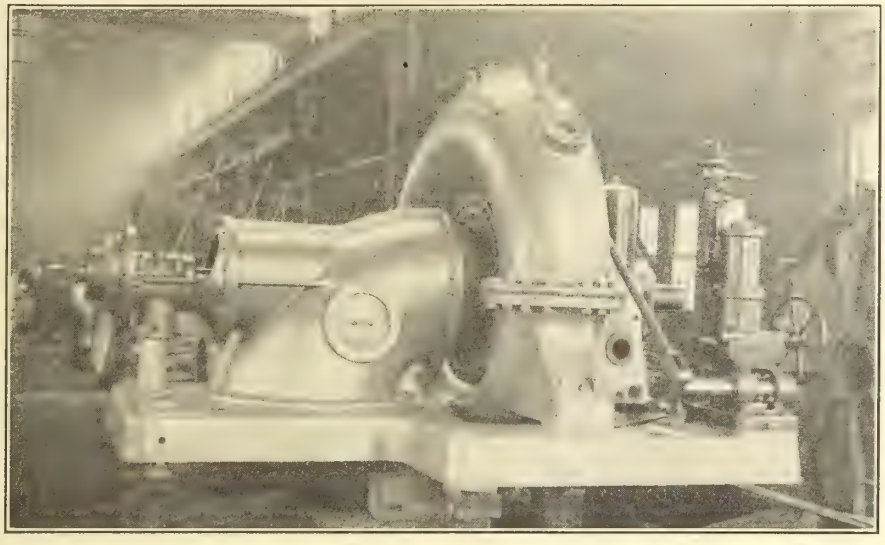
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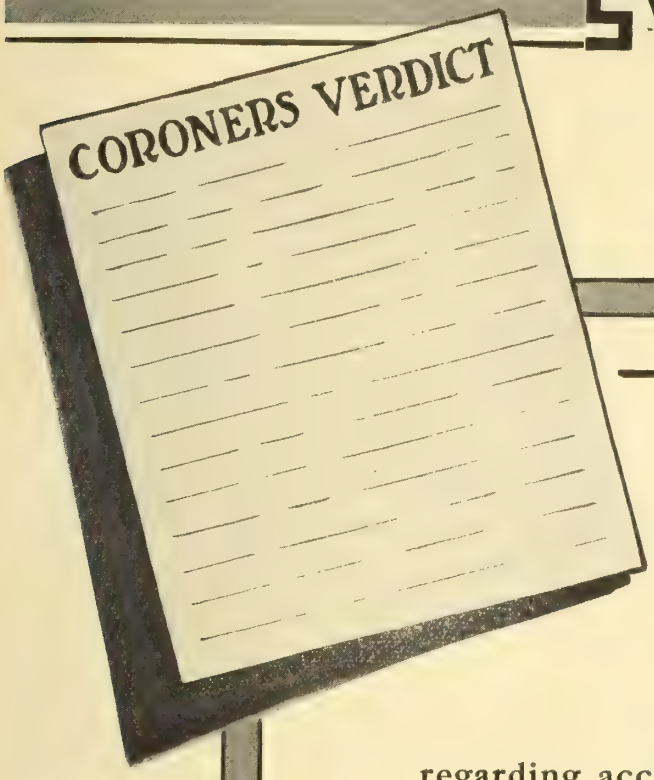
(Continued on Page 50)

SQUARE D

SWITCHES

D

THE ORIGINAL SAFETY SWITCH



—and Your Verdict?

If there is one open knife switch in your plant a fatal accident like this is *possible.*

If you study the statistics regarding accidents due to contact with exposed switches you will realize how *probable* it is.

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Your electrician will tell you how and why.

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Walkerville, Ont.



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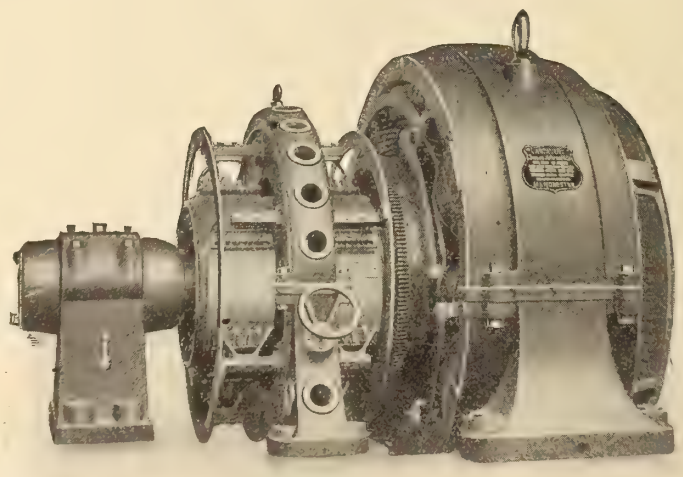
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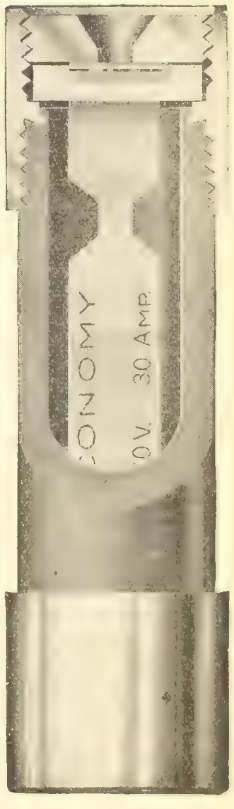
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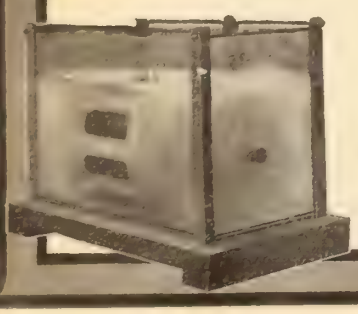
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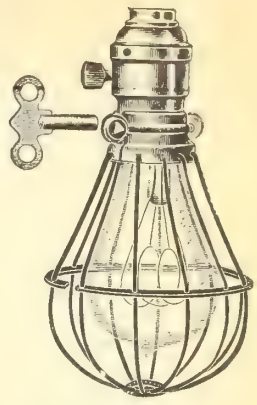
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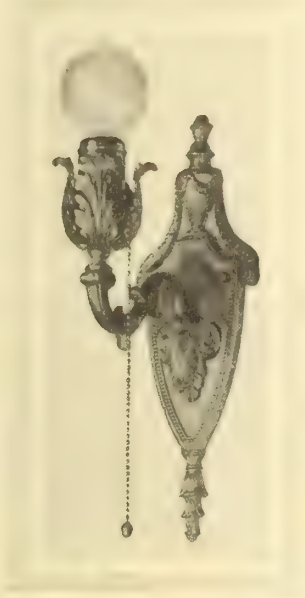
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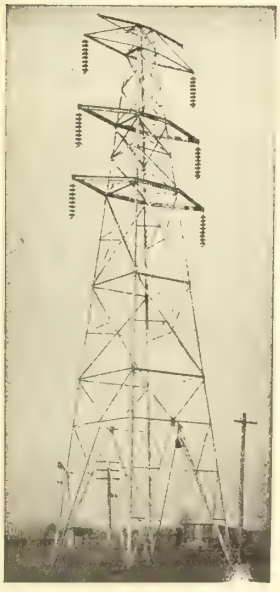
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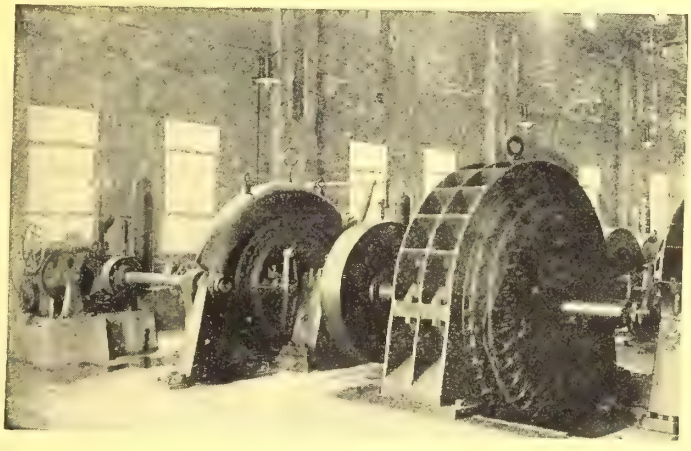
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How much have YOU lost in prestige through not being able to take care of your customers' business?

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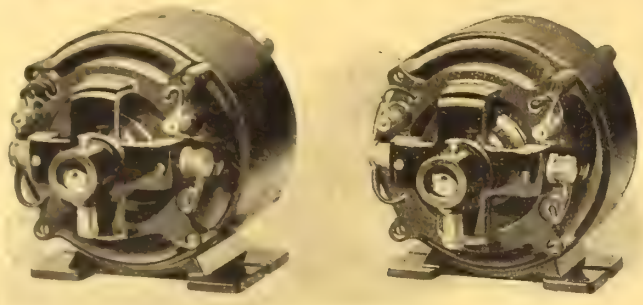
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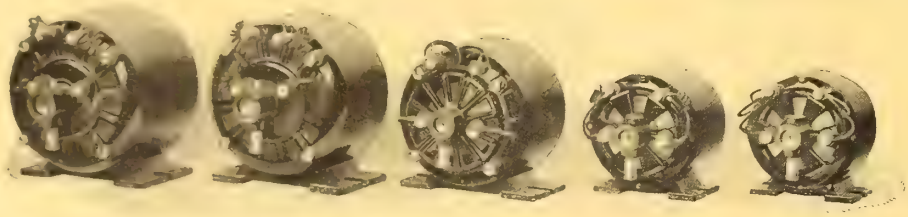
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25 and 60 Cycles and D. C. 110-120 Volt

H.P.	Speed Synch. R. P. M.	Frame No.	Code	Shipping Weight
1/50	1500	A-00	Sar	2[illegible]
1/30	1500	A-0	Sen	26
1/15	1500	A-1	Sul	26
1/10	1500	A-2	Tic	38
1/6	1500	A-3	Tup	45
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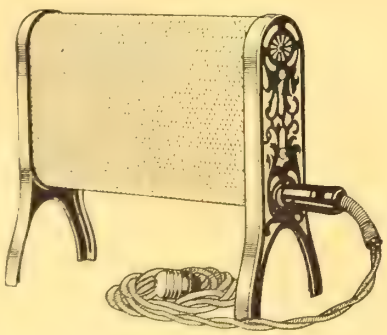
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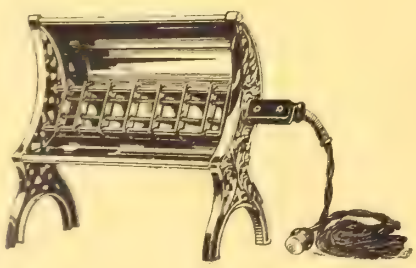
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